

Utah State University

DigitalCommons@USU

Elusive Documents

U.S. Government Documents (Utah Regional
Depository)

1941

Transactions of the Plague Control Conference of the United States Public Health Service and Twelve Western States

United States Public Health Service

Follow this and additional works at: https://digitalcommons.usu.edu/elusive_docs



Part of the [Epidemiology Commons](#), and the [Health Services Research Commons](#)

Recommended Citation

United States Public Health Service, "Transactions of the Plague Control Conference of the United States Public Health Service and Twelve Western States" (1941). *Elusive Documents*. Paper 2.

https://digitalcommons.usu.edu/elusive_docs/2

This Conference Paper is brought to you for free and open access by the U.S. Government Documents (Utah Regional Depository) at DigitalCommons@USU. It has been accepted for inclusion in Elusive Documents by an authorized administrator of DigitalCommons@USU. For more information, please contact digitalcommons@usu.edu.



TRANSACTIONS OF THE
PLAGUE CONTROL CONFERENCE

of the

UNITED STATES PUBLIC HEALTH SERVICE AND TWELVE WESTERN STATES

Salt Lake City, Utah

August 28, 1941

I N D E X

RA

644

P7

P4

1941

CONTENTS

PAGE

Roll Call	1
Surgeon General Thomas Parran	2,3,26,42,44,47,55
Governor Herbert B. Maw	2
Akin, Karl V. Charles V. Akin	20
Beatty, T. B.	26,35,54
Berry, E. L.	18,36,46
Bramhall, E. H.	49
Brown, Bertram P.	41
Cleere, R. L.	17,48
Cogswell, W. F.	46,47
Creel, R. H.	28,30,32,36
Cumming, Hugh S.	25
Evans, Donald	19,45,51
Hamer, Edward E.	33,47,55
Harrison, W. T.	29,35
Keith, M. C.	50
Manning, G. F.	48
McKay, William M.	3,19,49,52,55
Meyer, Karl F.	13,19,34,35,36
Mountin, J. W.	52,55
Parker, R. R.	10,33,35,44,47,51
Pazdral, Nuel	30
Scott, James R.	48
Stricker, Frederick	17,44
Wayson, N. E.	4,34,36,51
Williams, C. L.	27,37,54
Williams, Maysil.	50
Report of Executive Session	56
Report of the Committee of the Conference on Bubonic Plague	59
Map Showing Distribution of Rodent Plague, 1941	61

PLAGUE CONTROL CONFERENCE
of the
UNITED STATES PUBLIC HEALTH SERVICE AND TWELVE WESTERN STATES
STATE CAPITOL - SALT LAKE CITY, UTAH
AUGUST 28, 1941 - 10:00 A. M.

PRESIDING: Thomas Parran, Surgeon General of the United States Public Health Service.

ROLL CALL: United States Public Health Service:

Doctors J. W. Mountin, R. H. Creel, L. A. Fullerton, C. L. Williams, N. E. Wayson, W. T. Harrison, ~~Karl V. Akin~~, Charles V. Akin
Former Surgeon General Hugh S. Cumming, and R. R. Parker.

Consultants:

Doctor K. F. Meyer, Hooper Foundation

State Health Officers from the 12 Western States:

Doctors G. F. Manning, Arizona; Bertram P. Brown, California; R. L. Cleere, Colorado; E. L. Berry, Idaho; W. F. Cogswell, Montana; Edward E. Hamer, Nevada; James R. Scott, New Mexico; Maysil M. Williams, North Dakota; Frederick Stricker, Oregon; William M. McKay, Utah; Donald Evans, Washington; and M. C. Keith, Wyoming.

In addition to the above there were approximately 30 others in attendance consisting of:

Representatives of the United States Army Medical Corps:
Nuel Pazdral, Major, M.C., Fort Douglas; Thomas Sexton, Lt. M.C., Hill Field; and Dan B. Searcy, Capt. M.C., Fort Douglas.

Personnel of Utah State Department of Health.

State Board of Health Members: Doctors Callister, Beatty, and Jones.

Health Officers from: Salt Lake City, Ogden, and Provo.

Doctor W. S. Shepherd, Metropolitan Life Insurance Company

The meeting convened at 10:00 a.m., in the Governor's Board Room, State Capitol, Salt Lake City, Utah, August 28, 1941.

MORNING SESSION

10:00 a.m.

DR. PARRAN:

Before proceeding with the formal business of the Conference, we have the very great pleasure of having with us the Chief Executive of the State. I may say to the Governor, that we in the Public Health Service feel very close to the people in the State of Utah, in spite of the geographic separation between the city of Washington and this city. It happens that your senior Senator is the chairman of the committee in the Senate which has to do with Public Health Service legislation, and many of us know Senator Thomas very well. Your junior Senator happens to be a brother of an officer in the Public Health Service, and if he doesn't know about our problems, I should think it must be our fault.

We are very glad to be greeted by you, Sir, and I say to my colleagues, it is my very great honor to present the Chief Executive, Governor Maw of the State of Utah.

GOVERNOR MAW:

Ladies and gentlemen, I am delighted with the opportunity of coming in and saying hello to you, and greeting you on behalf of the people of Utah. We are very proud of our State. We think we have the best State in the Union; perhaps a lot of you won't admit it, but we have, anyway. We are glad to have you here. We are particularly glad to have the Surgeon General of the U. S. Public Health Service. Anything that the State government of Utah can do to cooperate with you in your program, we will do. The things you are to discuss here and the plans you will make will greatly affect us. We have a lot of country here that is undeveloped. We are going to have a lot of industries coming in and probably a lot of soldiers, and, with the influx of population and the great defense movement going on in the various States, undoubtedly there will be a lot of public health problems. We are very anxious to cooperate. We are anxious to keep the rodents down. We are anxious to keep the health of the people on the very highest level. And, I will say to you, Mr. Chairman, and to the members of the group, that whatever the State Government can do, we will do, and do it gladly. And if there is anything that we can do to make your visit here pleasant, feel free to call on us.

I greet you here and welcome you, and I hope your convention will be very successful.

DR. PARRAN:

We are very indebted to the State Health Commissioner of Utah as our host. I don't need to introduce him to our group, but I should like to present him--Dr. McKay--and tell him how much we appreciate all the arrangements he has made here for our convenience.

DR. MCKAY:

On behalf of the State Health Department, we want to welcome you here this morning. We feel highly honored. I think it is a great honor to have

not only our Surgeon General and at least seven other Public Health Service officials, but also Dr. Cumming, the predecessor of Dr. Parran.

We have representatives here, I think, from all of the Western States. We are very pleased to have our medical representation from the armed forces, as well as a number of representatives from the various health departments of the counties and cities in the immediate neighborhood. We are especially delighted to have Dr. K. F. Meyer from San Francisco with us. We welcome you. We know the meetings will be interesting because it is being handled by the United States Public Health Service, and it doesn't do things by halves.

DR. PARRAN:

I feel very fortunate that my predecessor in office, Dr. Cumming, has kindly consented to come to this meeting and give us the benefit of his wide knowledge and advice about the matter under consideration. I am not going to call on him for a speech now, because later in the proceedings we shall ask him to discuss several aspects of the subject, but I wonder if Dr. Cumming would come up and take a seat at this table.

Will you call the roll of the State health officers who have been invited, and announce the names of the Public Health Service officers who are here? After that we will pass around cards and ask those of you who have been invited by the several State officers to sign your name on a card and pass it on to the secretary. Before calling the roll, I might say that invitations were extended to the health officers of the States from which plague has been reported, and that this was the basis for the selection of States to be represented here today.

(Roll was called as listed on the introductory page of this proceeding.)

I recognize an old-timer in the public health field--Dr. Beatty. We are glad to see you with us. We are also glad to have representatives from the Army Medical Corps. Will one of the secretaries pass around this tentative agenda?

Pursuant to the Act of 1902, which authorizes the calling of regional meetings of State health authorities whenever public health conditions warrant such action, we have called this meeting to discuss the problem of plague in the Western States.

[Introduced into the United States in 1900, plague has spread in the rodent population, first in the Coast States, then in the Mountain States, and more recently in the western part of North Dakota.]

While we do not consider that the situation is alarming, we do consider that it is a matter of considerable concern on two scores: [First, there is a possibility that plague may continue to spread eastward and invade the cities of the Mississippi Valley; the second cause of concern is the reappearance of plague infected rodents in the San Francisco Bay area during the past year.]

I can say to you health officers that I am not an expert on plague. My education in this respect has been sorely neglected; we do feel, however, that in the personnel of the Public Health Service we have a group of experts

whose advice could very well be followed by all of us who are in positions of administrative responsibility.

It is not my purpose to go into the history of plague, or to take up in detail the present situation or the potentialities of that situation. I would prefer to leave that to those who will follow on the program. With your indulgence I should like to depart from the tentative agenda and proceed as promptly as possible to the major purpose of this Conference, which is to decide on the several steps which should be taken in order to deal with this situation, and to decide also the lines of responsibility, the relative functions of the Federal, State, and local authorities in dealing with this matter. We shall proceed very informally. At the outset, I shall ask several of the representatives of the Public Health Service to present briefly the several topics which have been assigned to them, after which we shall have a very frank discussion, participated in by all of the State health officers. Before the meeting closes I hope to have each of the State health officers who are here today discuss the problem as it relates to their respective States, describe what is now being done towards the control of plague, and, finally, tell us what in his opinion needs to be done in order to deal adequately with the situation.

The first discussion will be by Dr. Wayson, who is in charge of our plague control measures, with headquarters in San Francisco. Dr. Wayson, will you come forward? He will discuss the present status of knowledge with reference to **EPIDEMIOLOGY, PREVENTION, AND TREATMENT OF PLAGUE.**

DR. WAYSON:

Dr. Parran, ladies and gentlemen: At the suggestion of Dr. Parran, I brought along a collection of stuffed skins of representatives of the rodents that are scattered through the Western States. All of those represented here have at one time or another been found infected with plague.

Dr. Parran and Dr. Creel thought you might be interested in seeing the diversity of rodents. You have marmots, prairie dogs, squirrels of several varieties, the cottontail rabbit, the wood rat, kangaroo rat, domestic rats, and the kangaroo mouse. Those are the common names. If you prefer to juggle the scientific names, I will leave them to you. There is one specimen of a tree squirrel--the only representative of that group.

I think what I have to say will be best crystallized if I read the paper I have prepared:

EPIDEMIOLOGY:

Plague is one of several infectious diseases which are frequently characterized by septicemia and hemorrhagic manifestations and which have therefore been designated as the hemorrhagic septicemia group. A second important entity of this group has been named tularemia. This latter condition is mentioned because of subsequent references to it. All of the hemorrhagic group of diseases appear to be those primarily of the lower animals of which the rodents are of greatest importance because of their widespread numerical prevalence and their susceptibility to plague and tularemia. Each of these diseases may be readily transmitted to man under favorable and somewhat similar

circumstances, and each frequently results in serious morbidity or mortality. The two infections are often confused; they are distinct, however, in that plague is caused by Pasteurella pestis, and tularemia by Pasteurella tularensis.

Infection of man with plague is usually manifested by development of a localized lesion accompanied by a contiguous lymphangitis and lymphadenitis, or bubo, thus, bubonic plague. Frequently the lymph node is unable to cope with the infection and the blood stream is involved in a septicemia of greater or lesser severity; or, in some instances, a direct blood stream inoculation is assumed and septicemia is reported to develop in the absence of a clinically demonstrable bubo, the so-called septicemic plague. In the course of these, as with other septicemias, the lungs are affected in varying degree, even to the extent of a definite pneumonia. When this secondary pneumonia of bubonic or septicemic plague is accompanied by cough and expectoration it may be directly transmitted through the expectorated droplets and may very readily produce a primary pneumonia in those who come in even casual contact with the patient. Such a primary pneumonia is designated "pneumonic plague," and it may or may not be accompanied with evident local respiratory lesions and adenopathy.

The name "sylvatic plague" has been proposed for infections contracted by and through field rodents, but though this term may at present have an academic value in the consideration of some unexplained epidemiological features it is important to appreciate that plague is caused by Pasteurella pestis, and that it is transmitted from field rodents to one another, to rats, and to man. Furthermore, the development of the Manchurian epidemic of pneumonic plague, as well as of both the small epidemics of this form in the United States, was traceable to field rodents. Sylvatic plague is not a disease limited to rodents, and no evidence has been evolved to differentiate it from the plague known throughout the world. If sylvatic plague is an infection by an organism other than Pasteurella pestis, then the name is completely misleading.

All of the factors necessary to the development of bubonic and pneumonic plague in man have prevailed in the United States for the past forty years, as may be seen by the outbreaks of the bubonic form in California, Washington, Louisiana, Porto Rico, and Texas; by two outbreaks of the pneumonic form which have occurred in California; and by the scattered cases of the bubonic form which have been recognized in California, Oregon, Idaho, and Utah. It is thought likely that many unrecorded cases have occurred but have not been recognized.

Both of the pneumonic outbreaks and most if not all of the scattered cases probably originated with infected rodents of the fields and countryside. In all districts in which human cases occurred these rodents were found to be infected. The bubonic epidemics occurred in cities and were directly attributable to infected rats.

Under suitable though unknown conditions epidemics of pneumonic plague may occur in any community into which cases of bubonic plague are introduced. The development of such an epidemic is influenced, perhaps, by a low prevailing temperature and relatively high absolute humidity and, as stated above, such conditions prevail from time to time, if not annually, throughout the United States. Numerous speculations, including those concerning the virulence and

source of the infecting organism, have been advanced as explanations of the development of outbreaks of pneumonic plague, but none are founded upon observations accurate or complete enough to warrant conclusive decisions.

Epidemics of bubonic plague may occur in any community into which it is introduced into the rats, and under present conditions of travel either the rat or the human being may develop the disease many miles from the site at which the infection occurred.

Plague-infected rodents have been found in all of the States from the Pacific to the plains. More recently they have been found in North Dakota. They have also been discovered in Alberta, Canada. Squirrels, prairie dogs, wood rats, desert rats, meadow mice, desert mice, marmots, rabbits, and house rats have become infected. No species of rodents which are prevalent in these States appears to be immune to the disease. Thus it is evident that cases may occur in man in any of these States whenever circumstances are present which are favorable to transmission.

Throughout most of the States mentioned there are towns and cities in which rats are prevalent, and within striking distance of some of these communities plague-infected field rodents have been found in small or great numbers. The field rodents and rats frequent both the harborages and feeding places of one another, and infected fleas are carried by various means for miles.

For the practical purposes of preventive medicine, the transmission of bubonic plague involves three factors--animals suffering with a septicemia of advanced degree, ectoparasite vectors (principally fleas of many species), and the accessibility to these vectors to non-immune human hosts. In other words, the epidemiological formula is plague-infected animal x vector x non-immune man. As indicated above, pneumonic plague has but two primary factors, the patient with a pneumonia of plague and non-immune human contacts. Immunity to plague is rare in man after a previous attack.

The infrequency of human cases which develop during enzootics among rodents is probably influenced to a very great degree by the infrequency of contact. There are too few acutely infected rodents, too few fleas, or too few people in the immediate district of the infection. In New Orleans human cases occurred when the average incidence among all rats trapped was four infected among a thousand, and disappeared when the incidence fell to below one infected among a thousand. It is very probable, however, that the infection was not uniformly distributed among the rats and that the incidence among them was relatively great in the areas in which human infections were contracted.

Bubonic infection cannot be spread in the absence of vectors, primarily fleas, but among the many varieties of fleas capable of carrying infection the number necessary to initiate an epidemic has not been determined, and the number found on animals is not an accurate index. During a recent severe enzootic among squirrels in an area about Boise, Idaho, the average number of fleas recovered per animal was less than two. No estimate of the number of fleas in the nests and burrows is possible, and these insects spend only a part of their existence in riding their hosts. It is well established experimentally that the bites of one infected flea can produce the infection in

animals, and there is good presumptive evidence that the same is true in man. Nevertheless, other conditions being favorable, the greater the number of infected fleas at large, the greater the opportunity for contact with one of them. It may be pertinently mentioned that fleas desert a dead host for a live one casually passing by, but it is equally true that many remain for periods of at least twelve hours. Thus, one may collect a portion of the number present when the animal was killed, and, on the other hand, infected fleas may be found at large or on a non-infected host.

Under experimental conditions it has been repeatedly demonstrated that only thirty to fifty per cent of fleas fed on animals with advanced septi-cemia plague become infected. Thus the animal with acute plague is the dangerous animal from the standpoint of transmission. The animal which has recovered to some degree is, however, an index of the presence of plague. The subsequent course of the disease among other animals which are bitten by infected fleas cannot be predicted.

Communities of these rodents are diminished almost to extinction by enzootics from time to time, but an area in which plague has occurred among them should be regarded as a potential focus of infection until repeated adequate sampling and skilled examination of the residual rodent population reveal no infection. Instances have been observed, however, such as the epizootic among the rats of Hong Kong, and those among field rodents in Manchuria and in the United States, in which the disease has flourished for a period and disappeared without a noticeable return for many years. While these are remarkable phenomena without explanation, they are no more mystical than the rise and fall of various epidemics the evolution of which remains unsolved. In the rural areas of the United States where no consistent effort has been made to eliminate the disease, plague has recurred in field rodents with the annual season, or has been reintroduced from other areas.

Though the several varieties of ground squirrels seem to be the rodents of greater importance because of their number, distribution, habits, and susceptibility to the infection, it is essential to recognize that other rodents become infected and may well serve to extend or introduce the disease. Throughout the Western States the ground squirrels are relatively inactive for periods of from four to nine months annually, or are completely inactive and in hibernation. During hibernation they are of slight if any menace and do not spread infection, but other rodents such as some field mice appear never to hibernate and may carry infection. Observations made under experimental conditions suggest that plague may be harbored in hibernating animals and may recrudesce with their seasonal activity, but conclusive evidence of the validity of these observations is not at hand. Individual fleas are reported to have been preserved alive for periods of as long as one to four years, and it has been shown that some fleas will carry the infection under favorable experimental conditions of temperature, humidity, and food for as long as four to five months, although the period during which they may transmit the infection appears to be limited to seven to ten days. A practical working interpretation of these observations may well be that infected fleas may carry the infection over the hibernating periods and become infective with a rise in temperature in the spring. The conditions of temperature, humidity, and opportunity for feeding which exist in the burrows are unknown and are almost impossible to ascertain, but the seasonal outbreaks among squirrels take place at about the time of the emergence of the young animals which provide excellent non-immune hosts and a sudden four to five-fold increase in the population.

The spread of plague to territory which is not contiguous to a focus of infection may be accomplished through the transportation of fleas to adjacent barns and houses, or to more remote locations, and by the migrations of the animals. Rats will disappear from a location when disturbed or deprived of food, and will range for distances of three miles within a period of two weeks, as was demonstrated in New Orleans. Field rodents also migrate seasonally or when the population is too great for the available food supplies. Individual squirrels will range from 500 yards to probably several miles during a season, and the jack-rabbit is credited with a long range. While these latter animals are the particular subjects of infection with Pasteurella tularensis which is a serious menace to individual persons, this disease is also common to squirrels and prairie dogs, and the impression has been gained that its appearance in the latter may be taken as an index of a likely area of plague infection.

PREVENTION:

A discussion of the epidemiology of plague and the extent of its dissemination in this country seems to justify an appraisal of the prevention of its further development as a public health problem of the first magnitude. Since it is a potential menace in the States harboring infected animals and in both adjacent and remote States, it is immediately apparent that its control is a responsibility of both Federal and State departments of health.

The acceptance of this responsibility and the execution of an adequate control program over a period of years by the health departments should greatly reduce or eliminate this hazard. Experience has indicated also that the health departments should conduct the operations, since the delegation of the work to agencies over which they have no control may lead to conflicting activities and definitely prejudice the efficiency of the program. Furthermore, the conservation or promiscuous destruction of rodents by agencies whose viewpoint is conservation of nature or destruction for economic purposes has defeated and will defeat a proper development of this work. Morale in the health department is the essence of any success to be obtained--a morale which can withstand temporary setbacks. Laissez faire and the attitude reflected by statements such as "We can never get rid of all rodents," or, "Plague has been with us for forty years," or, "Plague has never been found in this district," will not result in great accomplishments. Attitudes such as these may result in a catastrophe which may properly be laid on the desk of the health officer.

The direction of attention to the problem today is opportune because of the remarkable abundance of natural food over a large extent of the infected States by reason of the rainfall of the past season. This food supply should assure a large crop of rodents for the coming season, and a great increase in rodent population affords fertile soil for an epizootic.

The logical control measures to be practiced will be directed at one or more of the factors--infected animals, vectors, human hosts. Some control may be effected with regard to all three.

The determination of the presence and location of the infection is the essential basis upon which a systematic and efficient prosecution of control must depend. This can be accomplished by thorough search of the territory, hunting and trapping many varied specimen of rodents, and submitting them

with their parasites to skilled examination and competent laboratory testing. The presence of infected fleas or other parasites probably affords an index of the presence of infection in the vicinity, but does not have the localizing value provided by the finding of infected animals.

Surveys to detect infection among rodents must afford adequate samples taken among these animals over a period of several seasons, and among city rats over a period of from several months to as long as a year. It is only through such systematic methods that the presence of plague may be detected before the occurrence of infection in man or an explosive outbreak among animals.

In communities threatened by the presence of plague among rodents, physicians should be stimulated to be alert to the possibilities of plague whenever they encounter buboes, septicemia, or rapidly fatal pneumonia, and should be admonished to advise the health officer of all cases of proven or doubtful diagnosis.

The diagnoses of plague and tularemia require knowledge of both their pathology and bacteriology, and though recognition of the two diseases may be simple it may also be difficult. Both infections are dangerous and should be handled under good laboratory discipline in compartments separate from other activities. The work should not be entrusted to technicians as a sideline. The selection and preparation of specimens for examination is likewise of importance and should be done by trained operators if the laboratory is to fulfill its function.

Having determined the location of infection, the place of immediate attack is definitely established. The rodent population in and around the area should be decreased or eliminated as rapidly as possible by shooting, trapping, distribution of poisoned baits, and the application of lethal gases such as carbon disulphide and cyanogas to the burrows. Under some circumstances the removal of the plant covering of the ground by mowing or burning may be necessary. The elimination of the rodents will indirectly destroy the fleas and parasites by destroying their essential food supply of mammalian blood. The control of rats can be effected by trapping, by depriving them of a food supply (keeping garbage in covered buckets and lining grain bins with metal), and by ratproofing buildings so as to make harborage inaccessible. The latter method is essential to a long-range program in cities. The choice of method and manner of application will be altered by the nature and habits of the animals concerned and by the terrain of their habitat, as well as by the extent and quality of the facilities available. After the danger points have been attacked, it will then be in order to extend the operations to cover wider areas the strategic importance of which is measured by future potentialities.

The human factor must also be taken into consideration. Education through publications and discussions both public and private with officials, physicians, and individuals are necessary and important in arousing public consciousness of the danger. By such means knowledge of locations of communities of animals can be obtained (a postal card query of landholders has been suggested); the nature of the disease and its threat to man can be portrayed; the methods and time of control can be explained with regard to the protection of health and crops; and the futility of promiscuous spectacular and localized sorties of poisoning rather than long-range organized annual attacks can be driven home.

The use of the several prophylactic "vaccines" is not a practical

measure for us, and the development of lasting immunity after inoculation with them remains an issue of debate and doubt.

TREATMENT:

The treatment of plague may be considered from two viewpoints: The prevention of the spread of infection and medical relief to the patient. The sick patient does not offer an important focus of danger insofar as dissemination of his disease through fleas or other parasites is concerned. Nor is the patient a threat to his associates and attendants when his affection is limited to the development of a bubo with or without septicemia in which there is no lung involvement with cough. But the patient whose lungs are involved and who coughs, sneezes, or expectorates is a very dangerous source of infection to those about him. He may initiate cases of pneumonic plague which is highly communicable and is attended by a nearly absolute mortality. Such patients should be isolated by a rigorous discipline which includes protection to the eyes, nose, and mouth, as well as exposed skin surfaces of all attendants and visitors.

The medical care of the patient consists chiefly of the therapy of febrile toxic conditions and supportive measures. Antiplague sera may be administered in large quantities with some hope of benefit, but though cures by means of these sera have been reported in individual cases, as well as in some groups of cases, their merits have not been conclusively established.

In the hands of one experimenter the administration of the sulfonamide group of drugs, and more especially sulfathiazole, to infected mice under controlled conditions has resulted in a definite increase in survivals and a prolongation of life among those inoculated. No instances of the use of these drugs to combat plague in man have been reported in numbers or under circumstances which permit conclusions concerning their value. On the other hand there have been no reports of clinical developments specific to plague which would interdict their use.

DR. PARRAN:

Since the first two topics on the program are so closely allied, I think we should reserve discussion of the first two papers until a second has been presented. Doctor R. R. Parker will discuss HOSTS AND VECTORS OF PLAGUE IN WESTERN UNITED STATES. Dr. Parker.

DR. PARKER:

Mr. Chairman and ladies and gentlemen: I have been somewhat doubtful as to what I was going to say, because I knew that my subject and Dr. Wayson's more or less conflicted. Unfortunately, or fortunately, he didn't trespass too much on what I had in mind to say.

I am very much of an amateur as far as plague work goes, compared with the Service men who have been in it for years. My connection with plague as far as active work is concerned dates from 1935 to 1937. In 1935 we heard of an epizootic among ground squirrels in Beaverhead County, Montana. For some years we had considered the possibility that plague might spread beyond the known bounds at that time. In the case of this Montana epizootic, we were informed that the ground squirrels were dying off, and I sent

Dr. Jellison to collect material. The facts are interesting because of the rapidity with which the epizootic was proved to be caused by plague. Dr. Jellison left Hamilton at noon on a Monday, arriving at Dillon, Montana, that evening. The next morning he located an old building on a ranch where the epizootic was prevalent, and early in the afternoon he started out in a truck. He hadn't gone a mile before he found a ground squirrel in the road. That evening the ground squirrel was dissected. A suspicious lesion was found; the animal was iced and sent to Hamilton where it arrived the next morning and plague was demonstrated. I doubt if there are many instances in which plague has been demonstrated in a suspected area so easily and quickly.

Nevertheless, we gave up our work there. We started on what we considered a long-term investigation of plague in the local rodent population over a considerable period of years, but we had only one man as an assistant and we tried to cover too much territory. Therefore, in 1937 we devoted ourselves only to studies on the possibility of scavenger and predacious birds being concerned with the spread, but we worked under very trying conditions. The only place we had to work was in an old brooder house. The infectious tissues were placed in a pail of lysol solution, and one day while Dr. Jellison was taking them out of the building he stumbled and fell and this whole pail of material went over his head, in his mouth, and some of it down his throat. He was extremely sick for about a month and barely squeezed through. No diagnosis was ever made. It is doubtful if it was plague, but we discontinued operations that year, and have done no active work on plague in Hamilton since that time.

As far as the immediate subject which I have been assigned is concerned, the material which I have to present comes from the work of the plague laboratory at San Francisco, various plague crews in the different Western States, the Hooper Foundation, and the California State Board of Health. I will endeavor to present it rather briefly.

Dr. Eskey demonstrated that plague was transmissible by 13 species of rodent fleas--both sexes are involved. Many species of fleas will transmit the infection to more than one animal. This of course is experimental work. Of the 13 species found capable of transmitting the infection, 12 species caused multiple infections. One flea of a certain species transmitted infection to 11 different animals, and several transmissions were obtained in one day by a single species.

Apparently, the rodent fleas approach the rat fleas in their capabilities as vectors of plague. Some species became infected with Bacillus pestis, but were unable to transmit it. Anyway, the results suggested that numerous species of rodents throughout the Rocky Mountain and Pacific Coast regions are vectors of plague.

Dr. Wayson stated that the number of fleas on different species of rodents varies. The plague laboratory investigations found the highest number on the California ground squirrel--Citellus beecheyi. Among a considerable number of animals examined, the average fleas per individual was 23.06, and the number ranged from that down to 0.4 of a flea per individual animal on kangaroo rats. Dr. Wayson also stated that the number of fleas found on an animal is not an indication of the number which are infected. Individual nests of California ground squirrels were found to contain as many as 69 fleas,

and in the case of Oregon ground squirrel--Citellus oregonus--the number dropped as low as 8 fleas to a nest. Apparently the fleas do not survive long in nests not inhabited by rodents. One other interesting point brought out by Dr. Eskay's work was the fact that an extensive epizootic of plague can occur in a rodent colony that is not heavily flea-infested. For instance, in Oregon, there was an extensive epizootic among the Oregon ground squirrels, but the number of fleas per squirrel was something less than one-half a flea. On the other hand, in the Douglas ground squirrel, which yielded 22 fleas per squirrel, plague has never been found. These are interesting extremes. The fleas' feces apparently are not a serious factor in spreading plague, although they are almost consistently infectious in infected specimens. The infection can survive in the feces for a period of a month or more, but Eskey made 30 attempts to transmit the infection through infected feces by continuous inoculation and was unsuccessful in each instance. So it does appear that there might be some doubt as to the part played by infected fleas' feces in disseminating plague.

The plague laboratory investigations also showed that the life of a flea--an infected flea--after it had once transmitted the infection, averaged three days. In some species it was less than three hours and in others it was a week or longer. Some specimens would transmit the infection only once, others several times. Apparently all fleas feeding on infected animals do not necessarily acquire the infection. It was found that fleas feeding more than 42 hours before the host died did not acquire infection at all. In other words infection was acquired in periods shortly before death, during which the organism was present in largest numbers in the circulating blood.

Dr. Wayson also mentioned the possibility of louse and tick transmission. Tick transmission seems less likely than louse transmission. It does seem to me it hasn't been sufficiently shown that rodent lice do not play a more important part in maintaining actual infection in rodents than now seems apparent.

Now, regarding the host animals. During the past few years plague has been demonstrated in between 20 to 30 different species of rodents of the Rocky Mountain and Pacific Coast region. It has been shown in 8 species of ground squirrels in California. The California ground squirrel in California has been found infected in 20 counties.

The Say rock squirrel has been found infected in Utah and New Mexico; the Columbia ground squirrel in Oregon and Montana; the Oregon ground squirrel in Oregon and Nevada; the Townsend ground squirrel in Washington; the Uinta ground squirrel in Montana, Idaho, Utah, and Wyoming; the Richardson in Montana and North Dakota--the Richardson was the animal found in North Dakota this year; and the Citellus richardsonii elegans, another sub-species of ground squirrel, in Wyoming. The golden-mantled ground squirrel has been shown by the Hooper Foundation and the California State Board of Health to be infected in five Montana counties; wood ticks and marmots in Utah, Montana, and Wyoming; three species of prairie dogs in Wyoming, Utah, Arizona, and New Mexico; as for chipmunks, I don't know whether more than one species was concerned or not in the Sierras in California and Nevada; the two species of deer mice--one in California and one in New Mexico; and kangaroo rats in the Southwest somewhere--wasn't it in Arizona and New Mexico?

Answer: Yes.

Also four species of wood rats in California; the flying squirrels and Tamarack squirrels in the Sierras; and the cottontail rabbit in the State of Washington. Dr. Eskey felt that ground squirrels, wood rats, and prairie dogs are the most important foci of plague in nature and the primary elements in maintaining the infection. He also believed that marmots might possibly serve in that capacity locally. Regarding the appearance of plague in other rodents, he and Dr. Hays felt it was secondary to infection in ground squirrels which of course is general and extensive throughout the Rocky Mountain and Pacific Coast States, and which now extends into North Dakota.

There is just one point I want to mention in finishing. The work done at the plague laboratory didn't in any way concern birds as possible vectors in the dissemination of plague. As previously mentioned, we worked on that in southwestern Montana in 1937. Scavenger birds did not appear to be of great significance, although they were very important in cleaning up rodents. Put several ground squirrels out on the road, and in an hour they will be cleaned up, particularly by magpies and crows. But Dr. Jellison found 8 different species of rodent fleas in the nests of predacious birds. The number of fleas was not large, but because a predacious bird picks up a ground squirrel and carries it some distance, some of the fleas may drop off the rodent. Of course the bird is not the normal host, and when it reaches the nest the fleas do not tend to stay in association with the bird host. Nevertheless, a point of great interest, perhaps, is that in the nest of a burrowing owl I found 6 species of fleas and 109 specimens. The burrowing owl is a predacious bird, but it builds its nest in the deserted burrow of a rodent. The fleas do not have so good a chance to escape as they do from the nest of birds such as tree owls and hawks, and the finding of such a considerable number of species and specimens in the burrow of a burrowing owl was suggestive of the fact that the predacious birds may function in a rather important degree in disseminating infected fleas. I thank you.

DR. FARRAN:

Thank you, Dr. Parker. Inadvertently, when Dr. Mountin was reading the list of Public Health Service representatives who were here, he omitted the name of a member of our National Advisory Health Council--Dr. Karl F. Meyer of San Francisco. We are very glad to have you with us, and hope you will undertake to open the discussion on these two papers.

DR. MEYER:

I had intended to come here and listen, but with your kind invitation I would like to discuss this problem because it has been near to me for almost 33 years.

A great deal of what I learned about the diagnosis of plague I owe to Dr. Wayson. Naturally he and I don't agree on some things; perhaps I am too much of an academician. But it may be of interest to this group to sketch briefly how the newer knowledge of plague came about.

I have been fortunate enough to live with it since 1933. In that year a fatal case of bubonic plague occurred in a small town outside of Los Angeles. From an epidemiological point of view it was exceedingly important to determine the source of this infection. There were three possibilities we could think of: First, that it had occurred due to contact with rats; secondly, that it

could have been due to exposure to fleas in the City of Los Angeles, because a year before during the Olympic games an infected rat was found on the 7th floor of a so-called rat-proof building; the third possibility was that the patient had contracted the infection during his temporary residence at Big Bear in the San Bernardino mountains. The incubation period of six days fitted perfectly into the latter explanation. I discussed the matter with Dr. McCoy, and he was of the opinion that the latter explanation was correct. There was, however, one argument against it, namely, we had been working in the Big Bear region for a period of two years, dissecting large numbers of burrowing rodents and squirrels in connection with the study of relapsing fever, and we had not found gross lesions suggestive of plague. For the first time the question was thus raised whether, for ordinary plague work, indication of anatomical plague in the squirrel is sufficient to establish a diagnosis.

Shortly after this case had occurred there was a report of high mortality among ground squirrels 23 miles north of Bakersfield and 250 miles from the Coast country where plague had been observed in California. As usual in such areas late in the fall, it was very difficult to find anatomically marked squirrels, and so nothing was found, but in springtime this area around Granite Basin burned furiously. It was a true epizootic--a fantastic mortality. You could walk over an area twice the size of this room and pick up 12 skulls or skins of dead squirrels. In some instances, we even succeeded in isolating the plague bacillus from the bone marrow of some of the ground squirrels. Well, here was a situation in which plague had appeared on each side of the big San Joaquin valley, and any one with some sense of ecology would easily realize the infection was not due to migration in an easterly direction, but that it came down from the hills. This new epizootic produced one human case, that of a boy who was unfortunately sent out of the valley to escape an epidemic of poliomyelitis. He contracted plague by playing around some of the huge rock piles where squirrel burrows were found. His case was bubonic in character. Later it developed into secondary meningitis, and the boy died of that about 21 days after the first symptom was recorded. He also had a blood stream infection and the plague bacillus was found in his brain. This was one of the longest chronic plague cases on record.

In view of the fact that plague had been seen on the eastern side of the valley, considerable attention was given to the matter and the public was correspondingly aroused. Biological Survey men were instructed to report any squirrel mortalities, and shortly after the first of July it was reported that in Warnock County, in the recesses of the mountains, squirrels were dying, or at least were seen sick. We did not know at that time that just across the border in Lakeview County a case of human plague in a sheep herder had been diagnosed by the National Institute. I went up there on the 4th of July, and in the recesses around homesteads I witnessed the high mortality among the rodents. Here was a huge area in which plague again burned on a large scale in a new kind of squirrel. No human cases resulted from that epizootic, but one thing was done which was very important. The city of Altrusa which was in the very heart of that area was thoroughly surrounded for five miles by a zone in which squirrels were destroyed by burning or by shooting.

The next year brought the unpleasant discovery that plague existed at Lake Tahoe. Unfortunately, in California human plague has been the sign to suggest the presence of rodent plague. Nobody ever thought it existed in

the area of Lake Tahoe. A woman who lived in a very nice cottage on the lake had handled some dead chipmunks which were around her summer resort. She developed a severe febrile disease which was suspected of being relapsing fever. She was taken to the hospital in Reno where a gram-negative organism was isolated from her blood. Later she developed carbuncular lesions. Again, plague organisms were isolated which were gram-negative, and the pathologist who saw these organisms was the same man who had done 14 autopsies on pneumonic plague cases in Los Angeles. He sent the cultures to me without any further history, and we played along for at least two weeks with them before it dawned on us that this might possibly be a plague organism. Well, the case was diagnosed as one of plague. Later, when surveys were made in that area of about 1,000 rodents, not one had any anatomical lesions, but the batches of fleas collected off these rodents showed existence of plague in that area. In fact, both in Lake Tahoe and in the San Bernardino Mountains, a period of from three to four years was required to prove conclusively from the anatomical markings on the squirrels that plague was then in existence, while flea pools showed it as definitely established. I think this is very important, and I agree with Dr. Wayson that the finding of infected fleas merely suggests that infected rodents are present in the vicinity. It does not, however, indicate the specific area in which the fleas have been infected, because healthy animals can carry infected fleas.

Now, speaking of healthy animals, let me just touch on some experimental work we have been doing. For example, more than 500 squirrels have been inoculated with plague organisms. About 50 percent of them survive the infection. Why that is so, I don't know, but it indicates that probably there is a large reservoir of innately resistant squirrels. These squirrels can be the vehicles of infected vectors.

Similarly, at Lake Huntington, existence of the infection was recognized by the occurrence of a human case, and the same holds true with regard to the two recent cases in Siskiyou County. I think I may say a few words about these two cases, because they are very fresh in my mind, and they have certain interesting angles which perhaps have a bearing on the formulation of the necessary educational and control program.

On the ranch where the first case occurred there was a reproduction of the old British manor conditions, which, as you all know, were responsible for plague in Britain before the agricultural revolution, as similar conditions now prevailing in Asia are responsible for the human plague which is so common there. In the first Siskiyou County case, near the patient's house there was a barn in which an old-fashioned wooden, unprotected grain bin attracted all the rodents in the vicinity. Beside the grain bin was a hallway about half the width of this room, and on the other side of this were the horse stalls where the boy who contracted the infection kept his pony. This hallway was practically undermined by burrows, and if you cupped up some of the dirt in your hand it was practically brown--teeming with fleas. You could see where squirrels had formed a track between the grain bin and the lava block of the walls which surrounded the bin. They resided under the lava block, where they had burrows or nests, but they came back over to the grain bin to feed. There were naturally also mice and wood rats.

Here was an example of the sort of thing that owners of ranches must guard against. They must free the immediate environment of their human habitations of rodents.

The second case which Dr. Wayson mentioned and which came to light only by accident was that of a five-year-old boy, who merely became ill with pronounced gastro-intestinal manifestations, pain in the lower right quadrant, nausea, and vomiting, and consequently you can't blame the physicians for not at once noting the development of a right inguinal bubo. It dawned on them that that might possibly be plague only about two or three hours before the boy died. This case also had some other problems connected with it. In the first place, the patient was taken care of at home under rather primitive conditions. When I got there, the whole place was still more or less soiled by coffee-ground vomitus which had been spit all over the place by the boy. He was a case of typical pestis major, where you always suspect that the lung may be involved. The whole family--relatives and everybody--were around there. They were all potential victims of a small outbreak of pneumonic plague. Fortunately, nothing of this sort happened.

This reminds me of something which I must tell you. Plague contagion is not always a question of high relative humidity and low temperature. I saw the following in 1940 in former German East Africa where plague was common. When the natives contracted the disease they wanted to go home and die with their relatives. One of them with an inguinal bubo left our salon and walked about 20 miles back to the corral. For the first five miles, though he stopped at every corral and talked with people, nothing happened. In the last 15 miles, however, he created foci of pneumonic plague, probably because by that time bacilli were in his lungs, and he dispensed them to his friends. This was in mid-summer, and mid-summer in that part of the world is a pretty warm affair.

Now, coming back to the recent case at Mt. Shasta City. The victim's father was gradually encroaching into virgin territory. He wanted to live with the animals; he wanted to live in the forest. But he was by training a city man who had no concept whatsoever of modern sanitation, who used his back yard as a garbage can. In the back yard and in the cellar he kept rabbits, and feed was scattered everywhere on the ground. There was also a shed for a cow, with plenty of feed. Chipmunks were around galore, and so were Douglas squirrels. There was unquestionably enzootic rodent plague all around, and it is not surprising that infected rodents were attracted to the place. Near the insanitary privy there was a dead squirrel, and the father and mother both said that every morning they had walked over the cadaver of this squirrel without paying any attention to it. It is not surprising that the boy picked up a flea. The tragedy could have been avoided if that county had had a sanitarian to teach these people some of the fundamental principles of sanitation. These are things which are deeply impressed on one's observation when one sees them.

One of the cases in Siskiyou County was treated with sulfathiazole. That is probably one of the reasons why the patient lived for about ten days. There was one thing which was unfortunate, and which will probably never happen there again, that is, they surgically removed an inguinal lymph node. That should not be done. It doubtless led to blood stream dissemination. The observation in Siskiyou County, furthermore, proves that the Douglas squirrel, which was always considered to be non-susceptible, at least under natural conditions, is subject to infection.

As Dr. Wayson has outlined, active measures have to be instituted. Aside from that, an effort should be made to find out what is known about the rodent population. During the past eight years in my investigations in connection with plague I have often heard ranchers say, "Well, my father knew about these things; he warned me that I shouldn't handle this," or, "We had that in 1902," or, "We had rodent mortality in 1906," and so on. In other words, these people are pretty well familiar with the extent of rodent mortalities. They will probably respond to any advice or counsel which we may be able to give them with respect to the handling of rodents on their premises. One must always realize that there are vast territories which have to be covered, and anything which we will do--except in the cities and towns where we have got to go ruthlessly after the rat population--will have to be concentrated on the human habitations. We should try constantly to keep down the rodent population, but that will be only partially effective and it requires organization and the use of trained personnel.

In 1931 and 1932 you could get a poison crew who would really spread the poison by hand, which means it was placed directly before the opening of the burrows. That isn't the case any more. Nobody wants to walk; they all have to ride, so there is a distribution of the poison from horseback, which it is true enough is effective. But you can't just scatter poison around. You have to know something about the ecology of the rodents and what type of poison they take. I think in certain places extensive use of bisulphide, cyanide gas, or of methyl bromide is necessary. We like this on account of experimental evidence which shows that we kill not only the rodent, but lice and fleas at the same time. I agree with Dr. Wayson that for practical purposes, the removal of the rodents will likewise starve the flea population. Nevertheless, in the vicinity of this human habitation in Siskiyou County the rodents had all been killed, but that place, five weeks after the death of the boy, was still a hotbed of fleas.

These things have got to be controlled, and I feel that the sanitation offices of the Western States will have a little more active work to do.

DR. PARRAN:

Do any of the State health officers have any questions to ask Dr. Wayson or Dr. Parker?

DR. CLEERE:

Dr. Karl Meyer described the epidemiology in connection with the cases occurring in California. Is someone familiar with the epidemiology of the cases in the other Western States?

DR. PARRAN:

Shall we wait until we get all the questions together? Dr. Wayson, do you care to answer all the questions?

DR. WAYSON:

I suspect that Dr. Berry could discuss the Idaho case. Dr. Stricker can tell us about the Oregon case.

DR. BERRY:

The case that occurred in Idaho last year was that of a boy about thirteen or fourteen years old, and so far as we have been able to determine this is probably what occurred relative to his acquiring this infection: The boy, together with another youngster or two, was out shooting magpies and little animals. We presume the little animals were probably squirrels, maybe cottontails or ~~jack-rabbits~~, and that the boys were also robbing magpie nests. In the process of examining one of the nests the boy got a scratch or an injury to one of his hands or to his wrists; I have forgotten exactly where the injury was. It was not considered serious, and the boy paid no attention to it. He developed a marked febrile condition, as I remember, about four to six days following the time he was out on this magpie-nest robbing expedition, and very soon became comatose so that they were never able to get a very accurate history of what did occur. We questioned the parents and the boy at a time when he was more or less rational, and we believe that was about what happened and the way the infection occurred in that case.

DR. PARRAN:

What were the symptoms?

DR. BERRY:

Rather typical of bubonic plague: marked fever and early development of marked prostration; later, development of lesions, especially in the region of the sacrum, some of the bubo type about the head and neck, and others that were plain ulcerated conditions. Infection started in the latter part of June, and the boy lived until the last part of September.

DR. PARRAN:

Dr. Stricker, what about the Oregon case?

DR. STRICKER:

The case occurred in Oregon in 1934, and was reported to our department on May 19, about the same day we received a telegram from the Public Health Service, saying that the rodents just south of Lake County were infected. The death occurred on the same day we received the notice from the Public Health Service. The man who became infected had been sleeping on the ground in an old deserted farm building. The place hadn't been well taken care of, and undoubtedly was inhabited by squirrels. The description of the case was typical, and the man died in three days. Buboes were evident. Our laboratory was a little puzzled at first, but we definitely found plague and sent the material to the National Laboratory. We have had other suspected cases which have occurred under the same circumstances.

DR. PARRAN:

Any other description of the epidemiology of individual cases?

DR. MEYER:

Another case occurred at Lake Tahoe. The Dean of the College of Engineering of the University of Nevada owned a cottage on the Nevada side. He drove up there in May to prepare his journal one Saturday afternoon. He returned again the next Saturday afternoon, but was barely able to drive back. He developed pneumonia--definitely plague. In order to please his wife, he had permitted chipmunks and other rodents to nest in the double wall of the cottage, so the whole thing was, you might say, a squirrel home. Here is a lesson in regard to recreation, that is, people should keep these rodents away from their own habitations. In a cottage not more than about a hundred yards away from the dean's place the people complained of an enormous number of fleas. I went into that home and picked up a camel's hair brush from the bed linen on one of the beds and found 10 fleas. We injected the fleas into a guinea pig and it died of plague. No other human cases appeared at that time.

In spite of this evidence there are people in the State of California who strongly feel that we shouldn't poison the dear little rodents again.

DR. McKAY:

We have no record in the Department of Health, but there was a known non-fatal case of plague in the southern part of the State. I don't know, Dr. Meyer, whether you had any connection with that case or not?

DR. MEYER:

Yes, I did. I was in southwest Utah about three months before, talking to a group of doctors. We were talking about plague, and I think that was the reason the group of doctors in Cedar City recognized a case of plague which had gone through the gamut of diagnosis. First, it was diagnosed as a case of diphtheria, then septicemia, then meningitis. Ultimately one of the experts tapped the axillary lymph channel and sent some pus to me, which proved conclusively that it was plague. That particular boy was, according to the history which I obtained locally, bitten by one of the squirrels which was brought to the home, so there was intimate contact with the sick squirrel.

DR. McKAY:

We also had another case last year--a suspected case--approximately 60 miles south of here, with multiple lesions and marked glandular involvement. It was diagnosed by the attending physician as plague. I think some of the material from the glands was sent to Dr. Meyer, but he was never able to isolate any organism from the material sent to him and he questioned the physician's diagnosis. Those are the only two human cases--or suspected cases--that we have had in Utah.

DR. PARRAN:

Any cases in Washington, Dr. Evans?

DR. EVANS:

No cases of late years in Washington.

DR. PARRAN:

Arizona or New Mexico? Are there further questions? If not, I suggest we pass to the next topic which was listed for early in the afternoon--THE INTERNATIONAL ASPECTS OF PLAGUE. After Dr. Akin has presented briefly this very complicated aspect of the situation, I hope Dr. Cumming will open the discussion. It seems to me we shall have before us the scientific aspects of this problem, and then the decks will be cleared for the discussion of the practical control methods by Dr. Creel and Dr. Evans. During the time they are talking, I hope the State health officials will be making notes, because after they conclude I shall call on each of them, as I have said earlier, to tell us what they are doing in their respective States, what they think should be done, some estimate of cost, and where the responsibility lies with regard to Federal and State authorities. Dr. Akin, will you discuss the international aspects?

DR. AKIN:

It is natural that this conference should concern itself chiefly with the local and interstate aspects of plague infection. Just now, the domestic point of view is pertinent in terms both of local health protection and of national defense. The fact should not be lost sight of, however, that the continued existence and spread of bubonic plague in endemic form among rodents in certain States, highlighted by occasional occurrences of the infection among humans, may become of profound significance to our international commercial relations.

Because of the world-wide distribution of plague and the tragic history of its assaults in many parts of the globe, the disease is universally feared, and we cannot pursue a policy of isolationism where this disease is concerned. The fact that Fasteurella pestis has found fertile soil, and, so to speak, has established itself as a hardy and spreading perennial in a portion of the United States, is no doubt a matter of interest and concern to certain foreign countries, particularly those against whom we have for many years operated an aggressively defensive quarantine. Now that the shoe is on the other foot, we have no good reason to hope that comparable or even more rigorous defense measures may not in time be set up against us.

Fortunately for ourselves, the treaties are designed to limit the extent and severity of the counter-defensive measures which may be employed. The United States is a party to three international sanitary conventions which serve as blueprints for international sanitary mechanisms. These are:

1. The Pan American Sanitary Code - Havana, 1924.
2. The International Sanitary Convention of Paris, 1926.
3. The International Sanitary Convention for Aerial Navigation, The Hague, 1934.

While it is generally recognized that these conventions provide maximum limits within which a contracting government may impose sanitary restrictions against another contracting government, we are apt to forget that every signatory government, including our own, is bound by treaty obligations to protect its confederates against the spread of the several diseases with which

the conventions are concerned. Plague heads the lists of diseases specified in all three conventions.

When a country undertakes to combat plague within its own jurisdiction, initial action is no doubt motivated primarily by the desire of self-protection; we seek first to defend ourselves against this disease which tends to become entrenched among indigenous rodents, and which, eventually, through accident or environmental circumstances, strikes at persons who come into contact with the animal hosts and insect vectors. The three sanitary conventions already referred to establish a much broader base of action; they represent our continuing legal and moral obligations to other governments with which we are associated in an effort to limit the spread of certain pestilential diseases through the channels of international commerce. A brief examination of the treaty stipulations concerning plague will make clear what should be done if the United States is to retain its position of sanitary leadership in the community of nations represented by these conventions.

The objects of the Pan American Sanitary Code will serve as an example of the philosophy which underlies other sanitary conventions to which the United States is a party. The avowed purposes of this code are:

1. The prevention of the international spread of communicable infections of human beings.
2. The promotion of cooperative measures for the prevention of the introduction and spread of disease into and from the territories of the signatory governments.
3. The standardization of the collection of morbidity and mortality statistics by the signatory governments.
4. The stimulation of the mutual interchange of information which may be of value in improving the public health and combatting the diseases of man.
5. The standardization of the measures employed at places of entry for the prevention of the introduction and spread of the communicable diseases of man, so that greater protection against them shall be achieved and unnecessary hindrance to international commerce and communication eliminated.

All three treaties require the immediate notification of first cases of plague among humans and rodents and subsequent detailed epidemiological reports of the first appearance of the disease and of secondary cases, including a statement of measures which have been applied for preventing the spread of the disease and for its eradication. Therefore, at regular intervals of not more than two weeks, the government of the infected country is required to submit reports on the state of its public health, particularly that of port cities.

While the International Sanitary Convention of Paris designates the rat as the principal agent by which plague is spread, the provisions of

the convention regarding rats have been made to apply with equal force to other rodents, and in general to any other animal known to be the means of spreading plague. This convention requires that signatory governments undertake constantly to keep themselves informed of the plague status of rodents in their ports and that every means be used to diminish the danger of the spread of the disease should the infection occur.

Briefly summarized, it may be stated that the international obligations of the United States as regards the occurrence of human or rodent plague within its borders are:

1. Prompt, detailed notification to other signatory governments when a case occurs or when the disease spreads from a previously reported focus.
2. Constant investigation to determine whether or not plague exists among rodents, and frequent periodical examinations of rodents in a plague-infected area for a period of not less than six months after the finding of the last plague-infected rodent.
3. To undertake whatever measures may be necessary to prevent the spread of the disease and to eradicate it from known foci.

In addition to the above, we are obligated to take effective measures to prevent the embarkation of persons showing symptoms of plague, and of persons in such close contact with the sick as to render them liable to infection. Measures must also be taken to prevent rats from gaining access to vessels calling at our own infected ports. Finally, we are required to maintain in and around ports, both large and small, sanitary services possessing organization and equipment capable of carrying out the application of the prophylactic measures authorized by the treaties. At this point, it should be understood that the measures referred to above are contemplated for the protection of the other fellow; special measures for self-protection will be separately considered in some detail for they represent what the other fellow can invoke against us under the permissive authority of the conventions.

The International Sanitary Convention of Paris states that while the sanitary measures and actions to which a ship may be subjected on arrival shall be determined by the actual conditions found to exist on board and the sanitary particulars of the voyage, it rests with each government to determine what procedure is applicable in its own ports of arrival and, in particular, to decide whether a certain foreign port should be considered infected. These latter provisions which recognize the sanitary sovereignty of contracting governments, though apparently arbitrary, are tempered by the specification that in applying protective measures due consideration must be given to control measures exercised by the foreign country of departure and to the sanitary treatment already applied by it to the vessel.

For many years the United States, through the foreign quarantine facilities of the Public Health Service, has exercised its discretionary power to determine for itself, on the basis of reliable information, which

foreign ports and regions should be considered as infected with plague. For example, the most recent official list of plague-suspected areas includes all of South America, Asia, Africa, and certain designated adjacent islands; all ports in the Dutch East Indies; the Island of Hawaii; and the European Mediterranean ports of Spain, France, Greece, Malta, and Istanbul.

The quarantine officer is guided by this list in determining the procedure to follow in handling vessels in foreign trade. The mere fact that a ship has entered a port in one of the plague-suspected areas does not define the character and extent of treatment, but the history of such contact leads the quarantine officer to scrutinize persons on board with special care and to subject the vessel to intensive inspection to determine the degree of rat infestation. The vessel is fumigated or trapped only if there is sufficient evidence of rat life to warrant the application of these measures.

If a case of human plague occurs during the voyage of a vessel, the quarantine treatment necessarily must be more drastic. The vessel is held in quarantine and is fumigated before the discharge of cargo. Cargo is then partially discharged under careful inspection to see that live rats are not carried ashore, and refumigation of ship and undischarged cargo is resorted to whenever evidence of active rat life is discovered.

In recent years the Public Health Service has come to consider the fumigation of ships for rats as a measure of last resort--an emergency procedure aimed at quickly reducing or eradicating a large rat population which has, in all probability, developed on shipboard because of the indifference and carelessness of the vessel's officers and crew. A vessel which is properly constructed, with due regard for the elimination of unnecessary enclosed spaces which afford safe rat harborage, and which is at all times kept clean, seldom houses a significantly large rat population. Ship sanitation, which includes regular inspection and supervised cleaning and trapping, plus the elimination of temporary rat harborages, has largely replaced fumigation, thus saving vessels much of the delay and expense to which they were at one time subjected. Prior to the current war, several thousand vessels of all flags were being kept under regular sanitary supervision by our quarantine stations. Not only was rat life practically eliminated on these ships, but there was a general improvement in living standards with consequent benefit to crew and passengers. This accomplishment is mentioned because it stems directly from rat control as a beginning, and because a number of foreign governments followed our lead. Needless to say, these advances in maritime sanitation would not have been possible without the whole-hearted cooperation of owners and operators and of the crews who worked aboard the vessels.

Maritime quarantine, be it for plague control or for the prevention of the introduction of any other dangerous disease, could not be intelligently prosecuted without accurate, dependable information regarding the whereabouts of endemic foci of disease and of the occurrence of epidemics elsewhere in the world. Under the normal conditions of peace, the quarantine officer has access to a number of sources of reliable sanitary information; the use of which makes it possible for him to plan with certainty the most effective control measures and to apply them with the minimum of interference with the schedule of arriving vessels. In the present state of world affairs due to the war, some wells of information

have been dried up while the flow from others has diminished, circumstantial or deliberately. It is not reasonable to suppose that a country at war would publish for the use of its friends sanitary information which might be of any possible comfort to an enemy. Faced with this condition and with the hypothetical certainty that the war will breed epidemics of dangerous disease, the quarantine officer must be more than ever alert--he must suspect every vessel which comes from a region about which he lacks information.

Except for the excellent reports of health conditions in the South and Central American Republics furnished by the Pan American Sanitary Bureau, the quarantine officer must now depend almost entirely on the reports of American consular officers in foreign ports for information regarding the incidence and prevalence of plague and other pestilential diseases. Now that the war has closed a number of official sources of sanitary information, the American consular bill of health, which must be presented at quarantine by every vessel coming from a foreign port, has gained greatly in value. We are indebted to the State Department and to its Foreign Service personnel for the care exercised in collecting the sanitary information presented in the consular bills of health without which quarantine officers would at this time be unaware of the world progress of the diseases they are required to combat.

If past experience may be taken as a guide, it seems safe to assert that unless effective plague control measures are applied for the eradication of rodent plague in our infected areas it will be only a matter of time until an alarming manifestation of the disease will occur among humans. If a human epidemic does occur, especially in a port city, the national health authorities of Central and South American countries, perhaps Canada, and non-infected regions elsewhere will take steps to protect themselves against the introduction of plague. Vessels carrying defense cargos which can afford no delay will be subjected to the delays incident to inspection and fumigation and the costs of transportation will be increased by demurrage and fumigation.

The experience of certain South American countries in which plague has spread to indigenous rodents other than rats shows how difficult a plague-eradication campaign can be when wild rodents are involved. Satisfactory success has, however, been achieved, but only at the price of constant effort, in which control measures have been simultaneously applied in all parts of the infected area. It is certain that the United States with its far greater resources will not fail to undertake and actively prosecute whatever measures may be required to secure for its plague-infected areas a clean bill of health.

DR. FARRAN:

Thank you, Dr. Akin. Dr. Akin has referred, among other things, to the sanitary conventions which have brought order out of chaos. The one man who more than any other in the world is responsible for the results of these conventions--the drafting of the agreements--is here today. I should like to ask Dr. Hugh S. Cumming if he would like to discuss any aspect of this problem.

DR. CUMMING:

I want to express my appreciation, first, for your courtesy in asking me, as Director of the Pan American Sanitary Bureau, to be here with you. It is rather interesting that, looking around this little gathering, three of the four men who have done the most, I think, to increase the efficiency of maritime and constant international sanitation against plague are here today: Dr. Creel, Dr. Williams, and Dr. Akin who, being a young man, has more particularly been interested in helping us with air transportation. I don't know whether it was a mere coincidence or not, but the modern pandemic of plague and I appeared on the public health scene at the same time. You remember plague had been quiet for centuries all over the world. We have read something about plague in London and plague in Florence. Some of us had seen it in Marseille. But in 1894, plague suddenly seemed to come out of the mountains of south-central China. I believe there were 12,000 cases or deaths in Hongkong and Canton, and in a few months plague had spread not only to India, but also to Europe. That was the year I happened to come into the Service.

Dr. Wayson, in one of his official documents said that there was reason to believe that plague may have been in San Francisco in 1896, and even more probably in 1898. Strangely enough, it didn't appear in South America until a Dutch vessel laden with rice came into Montevideo, discharged cargo, and left to go up into Paraguay. This started quite an extensive epidemic which eventually became pneumonic plague, which then spread to the Argentine. It was first diagnosed in the Argentine.

As I remember, plague didn't appear on the West coast for several years after that. I advise you gentlemen to read the history of plague; there is a great romance in the story and, as Dr. Olson used to say, it has multiple manifestations as far as its etiology, transmission, and clinical manifestations are concerned. There are some countries in South America which have never had plague so far as is known. There are other countries, as you know, where plague has occurred in severe epidemics and then disappeared. In other countries plague has continued to exist despite the intelligent and active efforts of health officials and others.

Various reasons including sun spots, humidity, and barometric pressure have been given as the cause of plague. As a matter of fact there is still much that we don't know about it. In 1929, the then President of Peru asked me as Director of the Pan American Sanitary Bureau to take over the sanitary ports in Peru--the first time they had done anything of that sort. Since that time we have been conducting a more or less successful campaign down there. At this time, Dr. Atilio Macchiavello, a distinguished scientist, is studying the various manifestations of plague in Brazil and in Chile.

Somehow plague seems to stimulate an unusual reticence in the average health officer. It is very difficult to get true reports about plague conditions in ports. One reason probably is because a true report might interfere with commerce. The particular clause to which Dr. Akin referred, the reservation that each country reserved to itself the right to determine which ports should be considered infected, was introduced at the Paris convention by agreement with the State Department, and

we had a real struggle with Great Britain and Germany and France before we could get it incorporated in the agreement. I think we rather carried our point by bringing up the fact that there were at that particular moment and date 27 clinical cases of plague being treated in one hospital in Paris which had not been reported by the French authorities. I think it is necessary for countries to place a good deal of dependence upon each other's good faith in reporting, and at the same time make a reservation in writing that you really aren't going to believe all they tell you and are going to reserve action. Possibly, recent political manifestations have shown the wisdom of that reservation in other respects. This may be the proper time to mention a recent development in the fight against plague which may have practical value. Recently one of our best sanitary engineers--Hopkins--saw somebody in Cuba using a flame thrower to destroy some growth while clearing a ditch. He went back to Peru and considered it a while, and finally asked me to send him two flame throwers with some modifications. They are now being used increasingly with remarkable success. It has been found that by using flame throwers, you not only destroy the rodents in the subterranean burrows with the high temperature, but apparently you exhaust the oxygen too, and very frequently you find the animals dead from the lack of oxygen. I think Dr. Meyer and Dr. Wayson look very skeptical about this, but the reports which we have bear it out. The common animal that we have to fight there is the rat, and since the houses are built of adobe these flame throwers can very readily be used in cleaning out a house. You know, of course, we use the flame thrower for cleaning paint off wood, and by rigidly moving the flame up and down all the vermin can readily be killed--not the large vermin, but the insects. This is the most practical thing I have seen. Whether it is because of this or just an accident, it is a fact that there has been almost no plague reported in Peru this year. It is possible, of course, that this may be due to meteorological conditions.

There are only three countries in South America now in which plague is being reported, although all countries are being watched closely. There is a good deal of apprehension on our part and that of the Argentine authorities because of the millions of tons of wheat for which there has been no market and which has been very difficult to store. At first it was stored regardless of rat danger, and there was some plague found in one or two towns. Now they are going about it very carefully and trying to build rat-proof warehouses to store their wheat. Thank you.

DR. PARRAN:

Thank you very much, Dr. Cumming. I noticed, with you, some smiles of skepticism regarding a flame thrower destroying insects in a bamboo hut, but I have been very interested in your report of the use of this method, but we must realize that in many parts of the West fire is a very great hazard. Yet, there may be many areas in which flame may be more effective than other more traditional methods of control. We hope Dr. Creel will discuss that this afternoon.

DR. BEATTY:

Mr. Chairman, I very distinctly remember the other--perhaps the only other--meeting on plague which the Public Health Service called before this. It was in 1902 when plague appeared in California. The people

out there were not very inclined to recognize it; in fact, they not only didn't recognize it, but were so inactive that the Public Health Service called a meeting of State health officials in Washington to consider what to do about it. The meeting was held and notice was served on the health authorities of the different States--and particularly California--that unless the presence of plague was acknowledged and measures adopted immediately for the purpose of controlling it, the various States agreed to institute quarantine restrictions against California. Do you remember that, Dr. Cumming?

That brought on several things, among which was one of the most extensive rat killings ever heard of. It was an interesting illustration of a common attitude on the part of the public to conceal the presence of these diseases in deference to certain local interests. Dr. Cumming referred to that in connection with the reluctance of the officials to admit the presence of this disease. The same thing has occurred in connection with other diseases. In 1905 the newspapers in New Orleans attacked any one who mentioned yellow fever, and that led to disastrous consequences, because there was really yellow fever there. It got beyond control, and one of our Public Health Service men had to be called in to suppress it. Furthermore, he did a pretty good job, because it was suppressed. But I am especially interested in the comparison of this meeting with the one held at that time on the same subject.

DR. PARRAN:

Thank you very much, Dr. Beatty. Any questions?

DR. WILLIAMS:

I would like to emphasize one particular which Dr. Akin merely mentioned, because I would like to use it later, and that is the matter of inspection. We think there are very few people who realize that the Service has developed inspection almost to an art. The inspectors in a quarantine station can tell with almost exact certainty whether a ship is infested with rats or not. They will miss in very very few instances. I think they can tell within 10 percent the number of rats on board infested ships, and it is such inspection which has so greatly improved eradication of rats on shipboard. Before we had such inspection, ships had to be treated according to whether they were from infected or inspected areas. They were fumigated in any case. After good inspection was developed, it was possible to tell the ship-owners, "If you will keep that ship free of rats then you will be kept free from fumigation." That has been a great stimulus. Infestation inspection has been developed, as I say, to an extent that it was almost unbelievable. I have seen many inspectors who were never more than 10 percent away from the actual count, even when ships were infested with up to 200 rats. The most remarkable instance was one in which a fumigation inspector could find only 21 rats on a ship where the inspector said there were 35. The inspector went back the next day, investigated some places which had been missed, and found exactly 14 rats. That same technique can be developed on land; the infestation of rats can be determined as readily on land as on ships by careful and properly trained inspectors.

DR. PARRAN:

Any further discussion? Dr. Creel.

DR. CREEL:

Dr. Parker makes a point of the apparent immunity of the Douglas squirrel, and I think it might be of interest to say that one reason why the Douglas squirrel has not previously been found infected is due to the fact that it is largely, almost exclusively, confined to territory north and west of the Sacramento River, and until these cases occurred in Siskiyou County the infection had not extended either to the north or to the west. In other words, the Sacramento River had constituted more or less of a barrier, but I think the department will find from now on that the Douglas squirrel is no more immune to plague than any other squirrel.

DR. PARRAN:

Further discussion? One point which we overlooked in making up the program was any specific discussion of the importance of this discussion to the military service authorities. Dr. Harrison, if you are at the meeting this afternoon, I hope you will discuss that, and I hope that some of the medical men will have something to say of that. Dr. McKay, do you have an announcement to make?

DR. MCKAY:

I have been requested by Mr. Bramhall to announce that the laboratory section of the Utah Public Health Association is holding a meeting tomorrow evening at the Beau Brummel Cafe with Doctor K. F. Meyer as guest speaker. All are invited to attend. The members of the State Board of Health have been rather eager to hold a short meeting with Dr. Parran and the representatives of the Public Health Service, and because of the lack of time and the fact that Dr. Parran may have to leave earlier than he intended, it has been necessary to call this meeting for 12:30. The meeting will be held at the University Club.

Meeting adjourned until 2:00 p.m.

AFTERNOON SESSION

2:00 p.m.

DR. PARRAN:

The conference will be in order. As we indicated before the noon recess, we have asked Dr. Harrison to discuss the plague situation with reference to the mobilization areas in the 9th Corps Area. As many of you know, Dr. Harrison has been assigned to liaison duty with the Corps Areas Service of the 9th Corps Area. Dr. Harrison.

DR. HARRISON:

Mr. Chairman, ladies and gentlemen: In the beginning, last November, when we were assigned and the liaison officers were sent to the various corps headquarters, I was so fortunate as to draw the 9th Corps Area. When we thought of the unusual problems that would confront this area, of course plague was the thing uppermost in our minds. Through the cooperation of the California State Department of Health and laboratories in San Francisco, intensive surveys have been conducted in all military installations in the 9th Corps Area as rapidly as they have opened, and, up to the present, in only three areas, with the possibility of a fourth, have situations been discovered which give concern. In the State of California our principal problem is in the 100th military reservation, the entire strength of which is engaged in maneuvers where infestation of ground squirrels is comparatively heavy, but infection is very light. As a matter of fact, under ordinary conditions we wouldn't worry about human infection developing in that area, except for the peculiar habits of the soldier. You know that he is, in his spare time, going to live closer to the ground squirrel than the average citizen; that is, in his moments of recreation, and also during maneuvers, he will come in more intimate contact with ground squirrels. In the Fort Ord area infection has not been found in recent years, but it was considered a potential danger area, and very intensive eradivative measures have been carried out. I might say the same measures are in progress now in the 108th military reservation. Boise, Idaho is, I think, perhaps the most critical area from the standpoint of extended infection. I don't think I have ever seen such an epizootic among ground squirrels as in this area. The little Townsend squirrels infest the desert around this pass, and you couldn't walk a hundred yards without finding several carcasses, although we don't know that they all died of plague. At least those we examined did die of plague.

Spokane, Washington, is another area where we have found a rather heavy infection in recent years. This year we have not been successful in locating infection in this area. I am authorized by the Surgeon General to say that the military authorities will conduct eradivative measures on military reservations. I am sorry to say that in some instances it has been necessary to conduct eradivative measures outside military reservations. It is expected that the States or the Public Health Service will conduct successful eradivative measures outside military reservations.

DR. PARRAN:

Thank you, Dr. Harrison. I think Major Pazdral from Fort Douglas is here.

MAJOR NUEL PAZDRAL:

I don't have much more to say than Dr. Harrison. We are, of course, vitally interested in anything which occurs in the vicinity of an army or military establishment. I looked through the report of the Surgeon General of the United States Army for last year. There were no cases of plague reported.

I believe there were several cases of tularemia, so the possibility of military personnel contracting plague is of course always with us. Since our prime mission in the Army is prevention rather than treatment, I think it would behoove us to fall in line with any campaign to eradicate plague.

DR. PARRAN:

Thank you very much, sir. Is there any discussion of what Dr. Harrison or Major Pazdral have said? Any questions you would like to ask? If not, shall we proceed with the regular program? We will ask Dr. Creel to discuss this problem. He is listed to discuss CONTROL MEASURES IN RURAL AREAS, but we shall not limit him to that. We shall let Dr. Creel say anything he is inclined to say, having in mind, Dr. Creel, that the purpose of this meeting is to formulate plans for controlling and eradicating plague.

DR. CREEL:

Mr. Chairman, ladies and gentlemen: Anyone following in succession Dr. Wayson, Dr. Meyer, Dr. Akin, and Dr. Harrison, finds himself either out of luck or in luck, as the case may be, inasmuch as the matter has been pretty well covered.

I notice that I have been listed to discuss the control of plague. I like to think in terms of eradication rather than control. The mechanism of plague eradication in rural areas is, in principle, at least, rather simple, but because of the conditions which obtain in many areas the execution is becoming decidedly difficult. The object, of course, in plague eradication is the destruction, or at least the reduction, in the number of rodents constituting the reservoir of infection, so that the line of communication between the infected and the uninfected areas may be broken. It is not at all necessary to wholly destroy a species or to destroy all the rodents in the area in order to effect this. I take it, regardless of the epidemiological factors involved, that it is fundamental that any infected squirrel got his infection from a previously infected animal, and also that if an infected squirrel dies under conditions and in an environment where no other squirrels pick up the infected flea, that breaks the line between this and any epizootic results.

There are a number of factors which make eradication of plague in rural areas difficult. The quarry is out in the open. The terrain may be extremely difficult. I was speaking to Dr. Wayson this morning about the difficulty of getting an eradication force up on some of the peaks. It is highly improbable, however, that there would be sufficient rodents in such inaccessible places to constitute a reservoir of infection.

I think we can consider that the squirrel is the main reservoir of infection. It may be suggested that prairie dogs and wood rats might serve as a reservoir of infection and keep the infection going. It is a matter of

speculation, of course, but I am very strongly inclined to believe that if we could eradicate the infection in squirrels, the secondary infection in the prairie dogs, wood rats, marmots, chipmunks, and rabbits would take care of itself and automatically disappear through the operation of natural causes. That may be true and it may not be. Certainly, the squirrel is the primary source towards which we must direct our eradication efforts.

The procedures generally carried out in eradication measures include shooting, poisoning, trapping, and fumigation. I think shooting is the most valuable of all because it not only serves to destroy the rodents, but it furnishes the laboratory with the materials on which we base our efforts, and after all, it is the result of our findings which make our eradication efforts effective. In poisoning, the main reliance has been placed on the use of thallium and strychnine. The solution is placed near or within the burrow. The squirrel is destroyed--poisoned by the sulfate of thallium. On the other hand, the poison from strychnine is absorbed through the cheek pouches. The squirrels pick up grain for storage purposes some distance from the burrow, and absorb the strychnine through the mucous membranes of their cheek pouches. Our friends in the Biological Survey convey the impression that so far as poisoning is concerned squirrels all have a college education, and that it takes a Rhodes scholar to circumvent that fact. I don't go that far, but there are a number of factors to be considered in poisoning squirrels. In the first place, when they come out of hibernation, they will not take grain. They will eat green stuff--vegetables--so that if you distribute poison grain, your results will be negligible. Later on, when grain is their natural food, they will take poisoned grain. The thing to do is to put out small particles of poison in various localities and in different vehicles. By this method it can be determined which poison the squirrel is taking. Then it can be distributed in large quantities.

In fumigation, carbon disulfide and cyanide have been used with considerable success. They have to be employed when the ground is still wet. They are more or less ineffective if used when the ground has dried out, because of the dissipation of the gas. Cyanide is really very effective, not only against the rodents, but also against fleas. Carbon disulfide is the older material of the two. It has been used for a good many years. Both of these substances have been used with a pump. I think it takes much less cyanide than carbon disulfide to destroy both the squirrel and the parasites.

I would like to revert to poison to say there is one defect: One never knows just how effective the poison is. You assume after an area is poisoned over and you see few or no squirrels that they have been killed. That might be partially supported by blow flies around the burrows. On the other hand, a large number of animals may have migrated to other areas. Therefore, one may have a false sense of security.

Trapping is resorted to chiefly against the desert rats. Here again, you are assured of a steady supply of material for the laboratory. One might say, "Well, if all these measures have been sufficiently effective against plague, why haven't we eradicated plague?" The answer is that they haven't been employed for twenty years. There has been no serious effort at eradication for over twenty years. There have been surveys, but that is not eradication. Last spring I was very much concerned. There was a district discussion about the spread of the plague, not so much about the results of plague in Nevada or Arizona, but about the spread of plague to the East. I saw no

reason why, if something wasn't done to prevent it, it wouldn't eventually get into the Mississippi Valley. I think that should be our main concern. I circularized the State health officers of 11 Western States, and, later on, saw them in person and urged greater participation at least in the survey. Six States weren't interested to the extent of furnishing a truck; one State furnished one truck; one, two trucks. California came along fine, as they always do. California has been plague-conscious for a great many years, and it doubled its force. Still, in California the eradication authority is vested in the Agricultural Department. The State Department of Health is trespassing on the domain of another department if it attempts any eradication measures.

To some extent, fumigation gives you no index at all as to what is the condition of infection, where it is, or where it is spreading.

It is not sufficient merely to employ individuals and give them guns and poison. Back of all that, to make it effective, you must have your organized administration, and the keystone--the most important part of an eradication force--is the laboratory. You depend on the laboratory to know the extent of the infection, to determine where you have to direct your greatest efforts. We have to go back 25 years really to evaluate what the results could be if a well-balanced eradication program were launched.

In the period from 1909 to 1915, the work in the California area--not only in the Bay counties, but in the areas extending down the San Joaquin Valley--the infection was reduced from 23 infected squirrels per thousand to one per thousand. The area of operations was 15,000 square miles of infected area and twice that much uninfected area. A force was sent down into Los Angeles County, and, in a period of two years, shot and examined 23,000 squirrels. We were convinced then, that this was uninfected territory, for in two years we found no infected squirrels. The same was true of San Luis Obispo, in Kern County. In other words, we delimited the infection by examining far beyond the boundaries of any known infected area. In all, we covered 45,000 or 50,000 square miles, no small area, as you appreciate. Of course, what makes this present situation seem so insuperable is its vast extension--thousands and thousands of square miles. Nevertheless, Dr. Wayson, with four trucks, assisted by survey trucks from the various States, has worked over four or five hundred counties. You have demonstrated infection in 38 or 40 counties, have you not?

DR. WAYSON:

48 of 375 counties during the entire period.

DR. CREEL:

I think another comforting circumstance is that the rodents are not uniformly distributed. There are vast areas where there are no squirrels, and which you can more or less set aside so far as eradication measures are concerned. The main effort should be directed towards certain wilderness valleys, and along certain passes. I do not think it unduly optimistic at least to express the hope--the belief--that a well-balanced campaign, financed to the extent of say five hundred to six hundred thousand dollars, and covering a period of five years, would result in eradication.

Now, going back to California as an index. The study of the infection was limited to a five-year campaign. One year we spent \$200,000, and infection was reduced so that in 1915 there were only three counties known to have infection, and in those the foci were very few and scattered. There was undue optimism at that time. Then came the development in New Orleans, and it was necessary for the Public Health Service to divert its funds for the control and eradication of plague there. We felt at least that we should assist the City of New Orleans as we had previously assisted San Francisco and the rural areas of California. Subsequently, the World War came along, so that gradually the work slackened and the infection resumed its course. But I have no doubt--and I think anybody else looking at the record would feel the same--that just one or two years more of work costing \$100,000 a year will result in the eradication of plague in California. I think that there is no reason for a helpless or pessimistic attitude about the eradication of plague in the Western States. It will have to be a long-range plan. It is hardly possible to effect anything in one or two years. Of course we have to realize that our work against the squirrels particularly, or other hibernating animals, is limited to their active season, and the index of eradication is necessarily based on laboratory examinations with negative results over a period of time. Our standard to indicate eradication for cities was one year's intensive trapping with negative findings. I think that standard has held up pretty well. Probably we would have to establish a standard for rural areas of at least two years' negative findings. I have a map here which may be of some interest to show the extent of plague. Of course most of the places shown in California are Bay areas, but that dates back to 1908 and 1909. The first infection found outside of California was in Jackson County and in Lane County, Oregon, and from there it apparently extended northward year after year until it reached Washington. Later it spread westward through all of the Mountain States, and now it has been found in North Dakota.

DR. HAMER:

I would like to ask Dr. Creel which species of squirrel has been found most frequently to carry fleas.

DR. CREEL:

I don't think any significant fact has been brought out about that.

DR. MEYER:

That varies. Recently a squirrel was picked up with 200 fleas on it. The rest of the squirrels showed as low as 2--some none at all. It varies tremendously. The squirrel on the surface of the ground does not reflect changes in flea population. The numbers go up and down with the conditions inside the burrow. It is a very delicate ecology, and many of us don't know the details at all.

DR. PARKER:

Dr. Creel was speaking about the possibility of the Cascade Mountains acting as a barrier. In 1935, as I mentioned this morning, we found plague in Dillon, Montana. This year--six years later--we found it 130 miles north of Dillon. In that six-year period it spread 130 miles, across the Continental Divide and over a country which is not dissimilar to the Cascade range in Western Oregon.

ANONYMOUS:

This morning, I understood Dr. Meyer to say that according to information which they got from old settlers something corresponding to plague existed in northern California as early as 1902, or as far back as the memory of these individuals went; I gather from what Dr. Creel says, however, that the plague we now have distributed so widely represents a gradual extension from the original foci in the San Francisco area, and that its spread has been gradual, and can be traced and measured to a certain extent year after year. Is there a conflict between those two points of view, or have I misinterpreted what each of you has said?

DR. MEYER:

I don't think there is a conflict. The main point of what I said was that we could definitely report a mass mortality among squirrels in Siskiyou County as early as 1902, according to the ranchers there. Now, it is difficult to prove that that was plague, because tularemia is also present in that area. On the other hand, there is a report that plague was present in 1900 around Ranger Station in Kern County, and there is no tularemia in that region. There was a mass mortality there which in every respect was analogous to the cycles which we have had in the past five or six years. With respect to the California situation, it is very difficult to say how this thing has spread, and we still have to know a great deal more about the migration of the respective kinds of squirrels.

DR. PARRAN:

It would be helpful to me, Dr. Wayson, if someone would indicate on the map the counties which have been surveyed in the past five years with regard to plague.

DR. WAYSON:

Yes, we can give you approximations of the areas that have been hunted over for the past five years.

DR. PARRAN:

Then we could have a map which would say certain counties were infected and that certain other counties were not. [See map, page 61]

DR. WAYSON:

The question seems to be why we haven't found plague before in western Washington and Oregon and in northwestern California. Part of the answer is that there hasn't been sufficiently intensive hunting in some of these areas. As you realize far better perhaps than some of our friends who are joining us, our efforts have necessarily been extraordinarily superficial. We have had to cover a million square miles in three years with four trucks. We have had to go to places that looked to us as possibilities as a result, more or less, of armchair speculation based on relatively little experience.

DR. BEATTY:

May I ask Dr. Meyer if there are any records or data determining whether plague existed prior to 1902 when it was known to have been introduced in California?

DR. MEYER:

No data.

DR. BEATTY:

This whole thing seems to have spread from that focus.

DR. MEYER:

A great deal of information concerning these wide areas on the map is based on surveys that have not been of an intensive character. Who would have undertaken to make a survey in Siskiyou, for example, on the basis of what he heard about any other counties? The human cases prompted the investigation, and I think that is true with regard to other sections.

DR. PARRAN:

Further questions of Dr. Creel? Dr. Harrison.

DR. HARRISON:

Just one thing I want to say: If you look at that map, I must confess it makes you shudder at the size of the territory. But there are a lot of highly cultivated lands in that area, and the problem is not great in cultivated lands. There is no squirrel problem in the cultivated alfalfa fields. The squirrel problem is in the marginal land--land in which it is not worthwhile from an economic standpoint to destroy the ground squirrel. I think if we remember that, the problem is not so big as it may seem from a casual glance at the map. Some of the desert areas are highly infected with squirrels, but they are not in the intensively cultivated part of the territory.

DR. PARKER:

I am conscious of the danger of analogy, but we run across certain phenomena in the case of tularemia which, if they occurred with reference to plague, might have some bearing on the epidemiology of the disease. We found several years ago that if you inoculate rabbits with tularemia strains of low virulence, they recover. If, subsequently, you inoculate them with strains of greater virulence, one of three things may happen: The animal may run a typical case of tularemia and die in the usual length of time; it may remain immune; or it may run a chronic course in 30 or 40 days with lesions on the body. If you kill the rabbit three or four hundred days later, you may find tularense tissue in the body. There is danger in drawing an analogy, but tularemia infestation is pretty closely related to plague, and it is barely possible that the same phenomena might occur in connection with the control of ground squirrels. I have had some experience in controlling the Columbia ground squirrel in Montana. When I had charge of the control program in the State we spent \$15,000 a year on 75 square miles. We didn't

reduce the ground squirrels. We used poison and gas, and continued it year after year, and it was just like standing in the middle of a stream of water and trying to hold it back. There may be other places--I know there are--where the same amount of money would cover a vast extent of country, and do much good, but there are many places in the West like this valley where the problem of keeping the ground squirrel population even at a minimum would be a very expensive proposition.

DR. BERRY:

I would like to know if plague is more likely to be present in squirrels in the latter part of the summer season than in the earlier part, and, if that is so, does that have a direct bearing on some of our surveys?

DR. CREEL:

Young squirrels, of course, are much more susceptible to plague than the old ones, so you would expect greater infection after the young squirrels came out of hibernation. There is also a question of the seasonal variation in fleas and the greater prevalence of fleas in one season than in another. Outside of those two factors, I don't know any that would affect the prevalence.

DR. WAYSON:

Apropos of Dr. Parker's analogy: I would say it might apply to plague. I say you might have plague which does not show gross pathology under section. It was on the basis of this theory that the so-called pooling of spleens of rats was done years ago. Gross pathology was not evident, but, upon the selection of spleens of several rats, plague was found.

DR. MEYER:

It is not merely an analogy; it is an actual fact. In 1935 I ran across squirrels in the Modoc County area, which showed no gross anatomical findings except perhaps slight enlargement of the lymph nodes. I took some of the material to the laboratory. Part of it was inoculated and cross inoculated. Part of it was sectioned, and didn't even show multiple minute abscesses, which were always thought to be a characteristic. Then, in the Huntington Lake area, I personally dissected a squirrel and saw no gross anatomical lesions. Yet, after inoculations and culture tests, the material yielded that type of latent plague which is entirely different.

May I add here, that with respect to the variable susceptibility of the squirrels, young squirrels are far more susceptible. In fact, when you make tests over the seasons, you find that the young squirrels have a high mortality. Next is the variation between susceptibility of males and females. The females are the more resistant to plague infection; this is so biologically and has been proven experimentally. Now, this method of judging the existence of previous plague by determining the innate resistance of a squirrel population--or of a rat population--doesn't work very well. You probably know the experiments of Sokhey in India who tested a large series of rats. He could always show that the amount of human plague in the community was reflected in the resistance of the rats. In Bombay the resistance was 80 percent, while down in Madras it was one to two percent. He thought from this he could conclude when the plague would operate. Some one suggested that he go to the mountains and get

some of the rats, and, to his utter amazement, he found the rat resistance in the mountains was 80 percent. We are making the same observations. We took the rats out of the San Joaquin range, where there was never any plague demonstrated, and large numbers of fleas showed that the resistance of that group of squirrels was around 50 percent. I have lost confidence in being able to judge from that the degree of infection which may have gone through the rodent population.

DR. PARRAN:

Any further questions or discussion? If not, we will ask Dr. C. L. Williams to continue the discussion of control measures with special reference to the rural areas.

DR. C. L. WILLIAMS:

Mr. Chairman, ladies and gentlemen: May I clarify something? I feel impelled to say a word or two about the infected area around San Francisco, as Dr. Creel took it up and Dr. Parker stated a rather different viewpoint in respect to the possibility of control work among field rodents. I had a year's experience---in 1916. That is quite a while ago, and seems to coincide with the period mentioned by Dr. Creel when the infection was reduced to a very small dimension. In fact, it was believed and stated that there was practically no plague about the end of 1914 and 1915. The year after that statement was made, however, Dr. Pierce conducted a shooting campaign and showed that plague infection still existed, but it was apparently in a rather small area around the Bay. The following year it was found in Alameda down as far as Modesto. It was found in Salinas and farther down, about fifty or sixty miles down below Gilroy. Eventually, in that year, it was found in San Mateo County, and, as a climax, we saw an infected ground squirrel in Twin Peaks Park in San Francisco County. That was in a period of about a year. It will apparently spread from a very restricted region to an area of about 10,000 square miles. That experience led me to believe that the control of the field rodents and ground squirrels, and the control of plague, was a formidable problem, and one which was going to involve a great deal of effort and money.

I think that forms an introduction to my subject, because we are going to leave the domain of the field rodents and come into the realm of the rat. Dr. Creel has mentioned that plague in field rodents represents a distinct hazard because that infection may bridge the gap between field rodents and the rats in urban areas. In the past 30 or 40 years, there have not been a large number of cases of human plague in the rural areas where animal plague exists in the West. There have been cases, yes, but no epidemics, or anything approaching an epidemic. When it bridges the gap to the rats in urban areas, however, you will get another picture altogether. You will get an acute epizootic among a dense population of rodents living close to human beings, and, as a result of that, you will get a more or less widespread occurrence of cases in human beings. I consider that the control of rats in urban areas is a more important factor in the control of plague than the control of field rodents. It is the rats that are going to produce serious economic loss, and I believe that for the money expended you can probably get a greater return in tangible results. Now, moreover, rats don't carry only plague; there is plenty of reason besides plague for eradicating rats. Here is a partial list of the diseases they transmit: We know about bubonic plague and typhus fever. There were something like 2000 cases of typhus fever reported in the South this year, and there is the probability of eight or ten more unrecognized cases. Then there are

meningitis, infectious jaundice, rat bite fever, trichinosis, dwarf tapeworm, several other types of intestinal parasites, bacillus enteritidis, and two or three diseases of animals. Recently, one species of rat has been successfully inoculated with poliomyelitis, which gives rise to the possibility that it may be a vector. The chances are that the list will be increased as we learn more of the rat.

That is a sufficiently large list of diseases to incriminate this animal. In addition, the rat causes tremendous economic loss. The Department of Agriculture considers it well worthwhile to expend very large sums of money to eradicate the animals. Now, in cities where bubonic plague occurs, the only problem is the control of rats. Control of fleas is a side issue because the flea goes from rat to rat and from rat to human being. The effort is directed primarily against the rat. It might well be directed primarily against the flea, but to date no one has given us any effective means of controlling fleas, except by eliminating and controlling the rat. Some time another effective method of flea control may be discovered.

When plague appears in a city, the immediate concern is to kill off rats as fast as you can. It is an emergency that has to be met quickly, and it is met by an eradication campaign. Now, I would like to draw a distinction between that and the control of rats on a continuing or permanent basis. Control of all these other diseases of rats cannot be met by an anti-rat campaign. Temporary control of plague or other diseases can be achieved by this means, but if you want to continue to control rat-borne diseases it can be done only through continued control of the rat--not just a campaign lasting a short period.

In a plague campaign the first essential, of course, is an organization to plan and direct the campaign. It is impossible to go into detail about this now, and there is no need to do so because Dr. Creel has covered it completely in his paper on the control of plague. The next step is to make a survey and find out where the infection is. In the survey the laboratory, of course, is an essential feature and should be established at once. The trapping force must be set to work, the rats must be carefully tagged to indicate the location in which they were trapped, they must be brought into the laboratory, examined, and then intensive eradication is instituted in the places where the infected rats were found. Human cases frequently give the first hint as to the foci of infection. One of the procedures is to intensify efforts in the areas where human cases appear. The eradication method used in the past has been principally trapping, with poisoning as a secondary procedure which was formerly relied upon more than it is now. Rats get quite wary of poison. At first they will take it readily, and if it is done by trained persons it is quite effective for a time. The main dependence, however, is on trapping, and it is the method which can best be carried on for a long time with results--definite results--of reducing rat population. When the focus of plague is discovered, fumigation is undoubtedly one method which will quickly eradicate infection in the area. It should preferably be done with hydrocyanic acid, which, in the hands of experts, is a highly effective procedure. But it must be done by experts; otherwise, of course, people will be killed by it. In the second outbreak in New Orleans, the great majority of infected rats were secured by fumigating buildings where human cases had occurred. Wherever a case was located, buildings were at once fumigated with hydrocyanic acid. It was not unusual to find 10 to 50 percent of the rats with plague--the greatest number I recall was 59 plague rats on the table at one

time, or at least 59 which had been macroscopically identified. The total number of rats in that building was about 130, so it was approximately 50 percent of them.

As a long range measure, we generally advocate rat-proofing. There are several kinds and degrees of rat-proofing. The permanent type of rat-proofing is a very expensive proposition, particularly in old buildings. It is so expensive that there has for years been an extensive search to find some method that would obviate it. In new buildings, it is not nearly so expensive. It can be incorporated in the original plans; after a while the community gets used to it and ceases to object to rat-proofing buildings. I think San Francisco is the best example of that. Ever since the outbreak in 1906 there has been provision for rat-proofing of new buildings. In New Orleans where they have a similar ordinance, the rat-proofing of buildings has not been kept up so well as in San Francisco. Of course there are many reasons for that, one being the difficulties of construction in that city. As a result, the city at present is quite as heavily infested with rats as it was in 1914.

Various other procedures have been tried--the most recent one to give some promise of a cheap method is called "vent-stoppage" and is being tried in Georgia. The idea is that if they can get the rats segregated into units, they can kill them off in those units. The plan adopted was to close all the openings in the peripheries of all the buildings, so that the rats living in the building couldn't get out and those outside couldn't get in and reinfest the building. No effort was made to rat-proof the interiors of the buildings. In several small communities in Georgia, this has worked like a charm; for example, in the town of Camilla, about two or three years ago, they had some 80 or 90 cases of typhus, and several more in the county. They applied vent-stoppage to all the commercial buildings--they didn't bother with residences--where there was any real evidence of rat infestation, and then they proceeded to eradicate the rats in those buildings with intensive rat-trapping campaigns and some poison. The result was rather startling so far as typhus was concerned. They didn't have any typhus the next year and the following year they had a total, I think, of three cases. The interesting thing is that while they didn't have any in Camilla, they didn't have any in the county either. That has been duplicated so far as typhus is concerned, and gives rise to the idea that the infection is more or less confined to an area where rats are heavily concentrated. The same thing does not apply in the same degree to bubonic plague. Now, for the last year, we have been trying out vent-stoppage in the larger community of Savannah. We have vent-stopped an area of 12 blocks, and retained 15 blocks as controls, but with trapping under the same circumstances in both the control area and vent-stopped area, to date the results have been rather disappointing. We are not sure, as yet, however, whether the experiment is going to show us anything definite or not. Carried on for another few months it may yield some results. There are some unusual conditions in Savannah, but I am of the opinion that the plan does not work so well in large communities as it does in small communities.

DR. PARRAN:

What was the measure of results?

DR. C. L. WILLIAMS:

The measure of results would be that in the vent-stopped buildings the rats would disappear and finally there would be no rats trapped, while in the control area the rats trapped would come down eventually to a certain level and stay there. One difficulty has been that in most of the blocks one or two buildings have failed to show any marked reduction in rats trapped, and it may be that in those buildings we have missed some openings. I may say that Savannah is an old city, and the construction of some of those buildings is something to behold. There are rat winds and runs which I think even Dr. Meyer would say were new to him. It is one of the few places where I have seen a rat-run from the building through a broken sewer pipe into the sewers. There was no question about it being a rat-run.

Now, I don't believe in a rat campaign as such where you have a serious, immediate menace such as plague or a very severe outbreak of some other rat-borne disease. I believe that the rat represents a continuing menace which should receive our continuing eradication efforts. Plague has been menacing us for the last 40 years in the West. We have typhus growing steadily in the South. We have all the other rat diseases, and we have enormous economic loss. In my opinion, the rat certainly warrants the establishment in all health departments of a rat-control division. In the area where we have field rodents, that might be expanded to rodent-control division, since the two problems are closely linked together. In areas where the field rodents are not a serious menace, activities might be limited to rat control. Now, that brings me back to the point I made this morning in discussing Dr. Akin's remarks on ship control, that is, the inspection of ships for rat infestation. The same thing can be applied to land. I see no reason why a health department should itself engage in rat eradication measures. I consider the rat to be a sanitary menace just like any other sanitary menace with which the health department deals. In the main, it should be treated like any other menace which the health department instructs the tenant or the property owner to take care of. I have the feeling that the health department should maintain an expert to tell when the premises are infected, to tell property owners how to eradicate pests, and, in some instances, to enforce control in individual premises. But I don't think the community should itself engage in rat control or rat-destructive campaigns.

There are many methods which a property owner can employ: He can do the work himself as they do on ships. Most operators of ships today undertake the work of killing the rats themselves; quarantine stations do very little of it at the present time. Or as a property owner he can employ others to control rats for him. An interesting sidelight on that is the exterminator--the commercial exterminator--whom I know very well, because I have been trying for 10 or 12 years to help them raise their standards. The present-day exterminator is likely to operate on the principle of killing off enough rats to show results to the property owner, and leaving enough rats so that his services will continue to be employed. The establishment of a central organization, however, which would require that premises be maintained rat-free, would enable the commercial exterminator to base his methods on the necessity of maintaining places free of rats, rather than allowing them to continue to protect his business. Of course, the maintenance of inspection would be at the local level. At the State level there would be experts who would be available for consultation and demonstration. And at the Federal level there would be, in addition to that, facilities for

training rat-control operators. The facilities of the Public Health Service are at present available, and a number of people are being trained. I think that is one of the things that the Service could very well do.

DR. PARRAN:

With your permission, I should like to call on the representatives of each of the States to discuss primarily the problem in their respective States. I think we have enough of the history, but we need to discuss the present problem and the present activities of the States with reference to plague control, together with your individual recommendations as to what should be done and what part should be done by the Public Health Service. Since California is a leader in this movement, we will ask Dr. Brown, State Health Officer of California to report first.

DR. BROWN:

One of these maps shows the situation in 1941. This map is not very clear to the people in the back of the room, so this is the Oregon line, and here is California. Our two cases in Siskiyou County are marked in red here and here. The infected areas are indicated in light green, and you see here in the Bay area the following counties: Contra-Costa, Alameda, San Francisco, the southern portion of Santa Cruz, Monterey, and Kern. This year in Siskiyou County there has been a return of 13 flea pools from Douglas squirrels. In San Francisco in May an infected rat was found in a Richmond garbage dump, and our efforts were greatly increased from that time on. At the present time we have eight field workers, eight trucks, laboratories, 20 men who are spending their entire time on plague, and one additional truck spending one-fourth to one-half time on plague. The areas I have just indicated have received the most attention. In all of these places the positives have been returned since approximately the first of July. If we had more workers to cover a larger area, and if we could examine more pools of fleas, would these areas which we now see in white remain white or would they show the green of infected areas? In Monterey, in the southern portion of the county, there were eight pools which were returned positive. Kern County has a total of 35 pools positive and 14 positive ground squirrels. Recently Dr. Parran visited the conference of the city health officers of the Bay area. A discussion was held concerning the approach which the State health department has to the problem of the control, and the following recommendations for action were made:

"PROCEDURE:

"Divide the area to be covered by trapping operations into trappers' districts, giving each district a number. Assign one trapper to each district. For the purpose of collecting fleas, each district should be subdivided and numbered, and should preferably cover an area of not more than two blocks.

"Trappers should determine by inspection the number of traps to be placed in each location, and should keep a record of traps so placed.

"A tag carrying full information as to location of the trap and the date should be attached to the right hind leg of each trapped rodent before it is removed from the trap of premises where caught. After tagging operation the rodent shall be dropped directly from the trap into a paper bag. This will eliminate unnecessary handling and consequent loss of fleas. No attempt should

be made to kill or remove fleas from rodents except in the laboratory by trained personnel. Paper bags containing rats should be kept tightly closed and tied with string to prevent the escape of fleas. Each bag should be dated and marked with district and subdistrict number from which rats were caught.

"During the rodent survey campaign special effort should be made to see that garbage and other possible rat food is stored in metal containers which are kept tightly covered and emptied at least once a week. Material such as boxes, lumber, etc., which may afford harboring places for rats, should be removed from premises or elevated at least two feet above the ground."

The basis for recommendations or suggestions of this type was the fact that while we had a county in which no infected area was known, when we put crews into that area we found ample proof of the existence of a considerable amount of rodent plague, which had caused two or three human cases. It brings up the question of these Coast cities. I am greatly interested in Dr. Williams' statement that it is the rodents in the cities which produce the greatest contact with human beings, and the question that I would like to ask is this: Do we know how much plague exists in the rats in the cities along the Coast? And I think I would make a plea that our survey activities be increased beyond what they are at the present time. We have eight trucks and twenty trappers. In the State Department of Agriculture, which has some Federal funds and some State funds, there is one truck and one crew who devote a portion of the time to the plague problem. The Social Security budget has a total of \$78,360. Our State budget has approximately \$14,000 that is spent on the rodent plague survey.

DR. PARRAN:

Have you an estimate of the amount that the State Department of Agriculture spends on rodent control?

DR. BROWN:

Unfortunately, I don't have that.

DR. PARRAN:

Have you any estimate as to what would be the additional amount needed in California to make a permanent survey department to deal with the problems of plague, as well as to carry on additional plague control measures?

DR. BROWN:

I don't have those figures. That could be arrived at from the cost of the trucks in operation at the present time.

DR. PARRAN:

Could you give us that before the meeting adjourns?

DR. BROWN:

Yes, sir.

DR. PARRAN:

Is this a matter which you think the State of California alone can handle with Federal aid?

DR. BROWN:

With Federal aid, yes.

DR. PARRAN:

With the present volume of Federal aid?

DR. BROWN:

I rather doubt that the State would be able to handle it without further Federal aid, from the experience I have had up to the present time. The public may become more concerned with the situation. After the discovery of the infected rat in Richmond I appealed to the Governor, who in turn appealed to the legislature. The legislature made a grant of \$10,000 for plague control measures and for enlarging the laboratory facilities. At the State Hygienic Laboratory we can now handle approximately 500 rats a day. We felt that many would be coming in from the cities along the East Bay with the increased work they are doing, and, much to our surprise, we get only approximately 200 a day. Nevertheless, the additional grant has been used for the laboratory because we are terribly overcrowded.

DR. PARRAN:

Dr. Stricker of Oregon.

DR. STRICKER:

Mr. Chairman: We have operated a truck in Oregon since 1934, after the death occurred in Lake County, and every year since that time, from probably the last of February until the first of August. That one year we did operate the truck on the West Coast in the counties and were not able to find anything positive in that region. We relied strictly upon the county agents to tell us about the reports of farmers on deaths of rodents. We followed each report. Around the infected areas in the Owen Mountains we have a situation very favorable to spread the disease. The cabins there are occupied only a few weeks of the year, and the rest of the year are inhabited by the rodents. We have warned the county and the man who owns the cabins of the situation. In addition to this, we have the cooperation of the Department of Agriculture and State Biological Survey people in destroying rodents. We have to rely entirely on the Department of Agriculture in the highly populated areas. The farmers themselves will supply the money for the poison, but the State has appropriated only \$5,000 for the eradication of rodents and a like amount for the truck. The rest is supplied by the Social Security funds.

DR. PARRAN:

Do you care to elaborate further regarding your own views as to the seriousness of this matter?

DR. STRICKER:

The present situation is not entirely satisfactory. I think we probably will have to put another truck on next year, and I think the suggestion made by Dr. Meyer with respect to our full-time effort and work applies as well to the farmers.

DR. PARRAN:

One additional truck will be satisfactory for survey and also for control in those cities?

DR. STRICKER:

Control is another question entirely. The eradication of rodents is costing considerable money. I don't know how much money you need for that--quite a sum of money because of the vast areas covered by rodents.

DR. PARRAN:

Is that a problem for the State itself?

DR. STRICKER:

Yes--with assistance.

DR. PARRAN:

What about rat control in the cities?

DR. STRICKER:

In the City of Portland we have examined rats continuously since 1934. One year there would be a campaign to eradicate rats, then it would drop off.

DR. PARRAN:

Biological Surveys operate in Oregon?

DR. STRICKER:

They do, yes.

DR. PARRAN:

State or Federal?

DR. STRICKER:

Federal.

DR. PARKER:

Dr. Parran, I think it might be of interest to discuss the dual organization of the control program in California which was organized in 1927 when the

State Department of Public Health found itself not able to secure funds for rodent control work, but the Department of Agriculture was able to secure the necessary funds. If I am properly informed they are spending \$80,000 a year on rodent control--rodent control particularly from the viewpoint of the agricultural interests--but it is understood that any time plague is located in a given area in California it is their paramount function to institute control measures. That \$80,000 isn't the entire expenditure because the cost is distributed as follows: One-third is paid by the State, one-third by the county, and one-third by the holder of the property, and the owner of the property can very well contribute his third in the form of manual labor, by furnishing horses, etc. So the total expenditure for control work is really close to \$160,000. The Biological Survey is doing control work only in the national forest. The rest is all done by the State Department of Agriculture.

The cost of running a truck is about \$13,000 a year.

DR. EVANS:

Dr. Parran, when we started out in 1936 to try to get some idea of the plague situation in the State of Washington we had an opportunity to become familiar with some of the old hunters' records dating back as far as 1896. Of course, all you can say of the hunters' records is that there were epizootics among rodents in eastern Washington over the same areas in which we have plague. We continued trying to find plague for a number of years, and recognized that we could hunt in certain areas year after year; one year we would find plague and another we wouldn't. We started reporting that so far as hunting squirrels is concerned we could hunt them for years and arrive at the same data, so we felt that we were disinterested until such a time as the question was raised about eradication. Of course, we have had plague in Seattle back in earlier days. I think the interesting thing is that we find our plague running down mainly through these counties here, some of it running over into the Blue mountains, and that in other areas not separated by mountains we find no plague. We can say that perhaps rivers afford a barrier, but we find plague across rivers, so I must confess that I am a little confused.

We had two crews this last summer cooperating with the Public Health Service. They furnished the men and we furnished the money, and we have tried to carry on some program of eradication, concentrating particularly around marine areas and around areas of previously ascertained foci. I am of the opinion that we will either have to do a whole lot more or stop altogether, so I was very much interested in the somewhat controversial remarks offered here this afternoon as to how easily it can be done.

I am not so sure but what it is not possible to conclude that we have foci which lie dormant for a year or two, then become apparent, then lie dormant again. Some of our work has led us to suspect that. I don't know how to prove it definitely.

DR. PARRAN:

Which was the next State in which the disease appeared? Was Idaho next?

DR. BERRY:

Doctor Parran, ladies and gentlemen: The survey work to determine the extent of the infection of plague in Idaho began in 1936. That year, in connection with some work done by the United States Public Health Service, we equipped a truck and sent a crew into the field for about two or three months, and again the following year. At that time, we found infection in the upper Snake River Valley and down in the southeastern part of the State. The following year the infection was still present. Some work was done over in the southwestern part of the State, and at that time plague was not found there. Unfortunately, the whole program at that time and for the next two years got tied up in a political knot, and due to some rather large headlines it was decided to discontinue State cooperation for two years. This year, we again ran the truck out of the garage, got it painted, sent it out with another crew, and did most of our work in the region around Boise and to the west and a little to the south.

The boy who died last year lived at Emmet, Idaho. Emmet is only 33 miles from Boise. That death was really what enabled us to put the truck back into the field this spring. Only one complaint was received regarding that work. We found our greatest infection, Dr. Harrison has pointed out, in the region immediately south of Boise, in the neighborhood of the Boise Air Base. We found numerous foci of infection. There, to the west over towards the western part of the State, north along the river up to Payette, and to the east over in Gem County in which Emmet is located. Infection was found not only in the squirrels themselves, but in the fleas on the premises. We had a rather rainy season in Idaho this year, and part of the time the weather was not very conducive to good work. Following the work in this area, we sent a crew down into Twin Falls, Gooding, and Lincoln counties, and we did some work up toward Hailey, and in Camas County. We didn't find infection, as I remember, in any of the burrows or in any of the fleas collected from the burrows in that area. Following that, the truck went north over the north-and-south highways, and did some work in Idaho County and over as far as Coeur D' Alene. The weather in the northern part of the State was rather stormy almost the entire time, and the vegetation was so rank that it was impossible to find many squirrels. No infection was found at that time. We plan to put the truck back into use next year. Following the work this summer, the Biological Survey, together with some other groups in the State, particularly the CCC, undertook considerable eradication work, particularly around the Boise Air Base. Reports following that work apparently indicate that it is quite successful, and we can say that the squirrels are now very scarce.

DR. PARRAN:

Thank you, Doctor Berry. Doctor Cogswell of Montana.

DR. COGSWELL:

Mr. Chairman, you know that I don't do much talking. We have a representative here from Montana, Dr. Carter, but I am going to start the discussion. In Montana no human cases of plague have been reported. For the last several years we have had a truck collecting these rodents and examining them. Infected rodents have been discovered in four counties. Last year the truck was out during the whole season, and they didn't find a positive case. This year infected rodents were found in a new county--Valley County. Now, in

Montana, we haven't gotten as excited over this question as you people, for the simple reason that the plague kills off these rodents. That is one good thing, and another is that we haven't got the flea that transmits plague. Now, under those conditions, would it be in accordance with good policy to encourage the spread of plague among the rodents? I think that is a question that you won't all agree on.

DR. PARRAN:

You say that you have no flea which transmits plague? Do you mean that you do not have a flea which bites humans?

DR. COGSWELL:

That is my understanding.

DR. PARRAN:

Dr. Parker, does that check with your information?

DR. PARKER:

That is true. There is only one locality in the State where there are any rats; it is in Fergus County around Lewiston. Rats have spread over 100 miles from Lewiston. Of course, there are fleas on the rodents, but none that normally get on man.

DR. PARRAN:

I should like to have some further discussion as to the distribution of the cheopis, which is primarily the flea that seems to transmit the disease to man.

Dr. Hamer of Nevada.

DR. HAMER:

Dr. Parran, I don't believe there has been any work done in Nevada except that by Dr. Meyer.

DR. PARRAN:

Do you consider the problem important?

DR. HAMER:

I do consider it of some importance, particularly around the only resort we have--Lake Tahoe. It seems that some infected rodents have been found there, and I believe there have been two human cases in or near that locality. I do consider it of some importance, and I believe that the fatal human case in Oregon is probably the one that came up from California to this county--wasn't it, Doctor Stricker? So, really, I don't believe enough work has been done to determine very much about it.

DR. PARRAN:

Thank you. Dr. Manning from Arizona.

DR. MANNING:

We have very little information on Arizona as far as plague in animals is concerned. Infected prairie dogs have been found in one area near the east central part of the State. Work has been done by the United States Public Health Service in some of the northern portions of the State south of the Utah line; otherwise nothing of importance has been done there. Aside from what United States Public Health Service field party has done, I don't know of any work that has been carried on in Arizona. If it has, Doctor Meyer would probably know. The only infected animals that have been found are prairie dogs.

DR. PARRAN:

Thank you very much, Dr. Manning. Doctor Scott from New Mexico.

DR. SCOTT:

No work has been carried on in New Mexico, except that done by the United States Public Health Service survey crew two years ago. A number of prairie dogs were found infected and a very small number of infected squirrels were found in Arizona last year in the area which adjoins Catron County. No infected areas were found by the survey crew. I have the report from this crew covering not only the original areas but some new areas in New Mexico.

DR. WAYSON:

Dr. Parran, would you like to ask Dr. Scott about control measures in his State? I was under the impression that some work was done by the Biological Survey.

DR. SCOTT:

I know only roughly. The Biological Survey has been carrying on a poisoning campaign and doing some shooting in order to send materials to Dr. Meyer at San Francisco.

DR. PARRAN:

Thank you. Dr. Cleere of Colorado.

DR. CLEERE:

As you probably know, the United States Public Health Service has maintained an intensive survey program seasonally in Colorado for the past several years. Dr. Wayson is probably much more familiar with this work than I am. I do know, however, that they made studies of most of the counties just above New Mexico. They also made studies in this section of Colorado this year, shortly after the report of an epizootic. You sent your unit and found plague in fleas, marmots, and ground squirrels. We know that we have a serious rat problem in the city of Denver. So we have both an urban and rural problem

of rodent control. I can sum up in two words what the State Health Department is doing in rodent control work--practically nothing. But we are cognizant of the problem. I would hate to say that the city authorities in Denver are not aware of the seriousness of the rat problem. I think we are going to need considerable assistance both financially and technically from the United States Public Health Service in formulating a definite program in Colorado. I might say that in Denver we have been concerned with suppressing two-legged rats and haven't devoted too much time to four-legged rats to date.

DR. PARRAN:

Dr. McKay of Utah.

DR. MCKAY

Practically all of the work in this State has been done with Federal assistance. We have used some State funds. Since it was done prior to my advent on the scene, I am going to take the liberty of asking Mr. Bramhall, Director of our Division of Laboratories, to explain briefly just what has been done and where plague has been found.

MR. BRAMHALL:

Dr. Parran, I shall try to present the situation for Utah briefly. In the summer of 1926 we had a human case of plague in Beaver County which attracted a great deal of attention. The United States Public Health Service sent in two of their mobile laboratories and within a day or two demonstrated that plague existed in the canyon east of Beaver. Very shortly afterwards they demonstrated it in the canyon just north of Beaver, and in another few days in Clear Creek which forms a pass over the mountain. Then they found plague in prairie dogs, in two areas on the east side of the mountains, on Route #89, in Garfield County. Incidentally, I believe that was the first time plague had been found in prairie dogs in the United States. That was all the work done that year. Next spring we studied the southeastern corner of the State with entirely negative results. We found a new plague area close to the center of population around the Strawberry reservoir--a great resort area--and we also found one within half a mile of the center of the little town of Morgan. Next spring we again operated for three months with negative results. Since that time we have not operated any trucks, but the Public Health Service has found plague in the desert pack rat just north of Kanab, a few miles north of the Arizona border, and they have also demonstrated plague in Rich County. So altogether there are actually about nine plague areas in the State. Our problem here, as we see it, is to get the cities interested in controlling rats. There is at least one place where rats and ground squirrels carrying similar fleas congregate together. We think that constitutes a serious danger.

We have not been able to get the affected cities interested in cleaning up their dumps or cleaning out their rats. They see no danger whatsoever in the situation. They are just dumping their garbage into piles and the rats migrate from the dump to the city and back again during the night. It is not unreasonable to assume that plague might come down the valley right into that area.

We haven't operated a truck since July 1, 1938, and unless we can get some financial assistance, either from the Federal government or from the Public

Health Service, we won't be able to operate. Our old truck is practically worn out, so either a new one would be necessary or the old one would have to be repaired and renovated.

DR. PARRAN:

We would be very glad to hear from any of the representatives of the Department of Agriculture.

Dr. Keith from Wyoming.

DR. KEITH:

Dr. Parran, ladies and gentlemen: The Wyoming Health Department has no rodent control program. We are glad to see the United States Public Health Service make their investigation. For several years infected rodents have been found in the western and southwestern part of the State. The last legislature appropriated \$30,000 for rodent control for the benefit of agriculture, but the health department has no control over those funds. It may be that we can work out some sort of cooperative measure in rodent control. I lived in central Wyoming for 35 years, and I never saw a rat. In the largest city in the State, Cheyenne, there is considerable infestation with ordinary black rats. The city dump is about one mile south of town and it is a great place for rats. It is set off in the hills where it is right in the natural habitat of the wild rodents, so that if these rodents were infected with plague it would be a very simple matter for the rats to acquire the infection. On the west side of town is a fort and a new cantonment, and last week a group of men came in from the United States Public Health Service and Mr. Adison's party with instructions, I understand, to try to eliminate the rodents in the area adjacent to the military acreage. They got permission from the town to shoot and poison rodents in the parts of that area that are controlled by the city. We have recently established a county health unit in Laramie County where Cheyenne is situated, and it is my intention to start some type of active rat control program in the Cheyenne vicinity in the immediate future.

DR. PARRAN:

Thank you very much. And now the State which is farthest east and infected is North Dakota. Dr. Williams from North Dakota, you are last but not least.

DR. MAYSIL WILLIAMS:

I am afraid I haven't very much to say about North Dakota; in fact, I haven't got used to the idea of having plague in North Dakota. It was only last month that we had the report saying that workers had found some infected fleas in ground squirrels in the northwest corner of the State bordering Montana. We have not, of course, had any program and I am particularly eager to gain some ideas today about what we should do. We do have a rat problem in several of our cities.

DR. PARRAN:

Thank you very much, Dr. Williams. Now, would some one clear up the question of the geographic distribution of the types of fleas which are

capable of spreading the disease to man? Who of the scientific people will undertake that? Will you answer that, Dr. Creel?

DR. CREEL:

I don't know that I qualify--they change the names of fleas so often. The common flea found on the squirrel in California back in the old days--back in 1915 and 1916--was the Hoplopsyllus anomalous and the Ceratophyllus acutus. In any event, Dr. Parran, no cheopis was found on any squirrels. We have never found a cheopis on a squirrel in California, and yet there have been a number of human cases which can be assumed to have been acquired from squirrels, not from rats. The fact is, that any flea in transmitting the disease acts as a hypodermic syringe. If it transmits plague from one squirrel to another there is no reason why it shouldn't transmit it to a human being. All fleas have their preferred hosts, and if they are dispossessed of the preferred host they attach themselves to a similar host. This is one reason why we have so few human cases. I know of no reason to assume that there are not fleas in Montana that can transmit the disease to human beings. The scarcity of population, however, adds to the improbability of a flea going to a human being rather than to another rodent.

DR. WAYSON:

Dr. Parran, I cannot give you the geographical distribution of all of the various fleas. I think Dr. Creel's point is very well taken, namely, that we have no concrete evidence that many of the fleas which have been experimentally proven to be carriers of infection will not carry it to certain rodents. I feel that we are not justified in saying that we have fleas that won't bite man. As we go on with these surveys we do find that there are rats and different kinds of fleas in these places, and I think it is dangerous to assume that man can't be bitten by some of them. I am sorry I cannot give you the geographic distribution of fleas.

DR. PARKER:

Dr. Parran, you were asking about cheopis in the East. It has been recorded in Ames, Iowa, and Lawrence, Kansas. To the best of my knowledge, the fleas or rats in cities farther east than that have never been examined. If they have, I have never heard of it.

DR. FARRAN:

One impression I have received from the discussion today is that there is quite a lot more we need to learn about plague. What is your pleasure, gentlemen? I think we have heard from all of the State health officers--have I overlooked anyone? We have a one hundred per cent attendance here of all of the States concerned. What is your pleasure from this point on?

DR. EVANS:

I don't know how many other States are faced with this situation. Our squirrels are out only part of the year. We try to use our crews on other work during the remainder of the year. That presents something of a problem. If it is possible for a State such as ours to call upon the Public Health Service for a training crew and conserve such funds as we do have and throw them in at the time when the squirrels are out on the ground, then we can tie up our equipment and

let it wait over the winter. Or, is there some way of pooling equipment or something of that kind? I have the impression that this program has to be headed by the Federal Government. The States should cooperate and assist in the planning of it, but the Federal Government should perhaps coordinate the efforts in various States so that one State doesn't come up with one set of conclusions and another State with another.

DR. MCKAY:

So far as actual morbidity and mortality are concerned in this State, tularemia is much more of a problem than plague. We realize that eradication of our rodent population--and when we get into tularemia, we get into the jack-rabbit field--would be physically impossible. That phase of it looks very discouraging to me. I agree, however, with some of the speakers that it would be money well spent to center our energies as a State department of health in cooperation with the cities, principally because it is in the cities where you find dumps and large concentrations of rats. In these Western States, with our tremendous stretches of open country, eradication of the wild rodents is out of the question, and the determination of foci of plague infection is difficult. One can conclude from the discussion here today that results are difficult and uncertain, and that we will be shooting in the dark when we go all-out on a program of extermination. But I think we can profitably spend what funds we have and what may be made available in cooperation with our larger urban areas on a campaign of rat extermination.

DR. MOUNTAIN:

In preparing the program, I put myself down to say something about Federal participation. I want to raise some issues before we leave. First of all, our deep concern about plague. I say "deep," and I personally feel that way, being the Chief of the Division of Domestic Quarantine, which was organized chiefly to prevent the occurrence and spread of disease. If anything should happen it would be pretty serious, since we have had our warning that plague is widely distributed throughout the western part of the United States. How far east this infection extends we do not know, but we have already found it in the Plains region. Whether we should attempt control or merely observe, I think is a point we should decide here today. If we decide to do something in the way of control, that something should take pretty definite form. It should be an integrated type of program which would be comparable in great measure from State to State. We could then go before the Nation and say that we are aware of the situation and are doing something about it. Whether we should attempt to control the rodents on an area-wide basis--I mean a Western area basis--or whether, as has been suggested, we confine our efforts to reducing the ground squirrel population around cities and the rat population in the cities, are decisions which I think we ought to make.

I don't think the desultory kind of action we have been taking in the past few years is going to get us anywhere. It certainly doesn't seem to be pointing up towards anything except gathering a little more information. Of course, we would like to know more of a fundamental character. We also need to know more about the nature of our job and how to go about it. But it seems to me that we have reached the point now where the discussion should be on what we are going to do in the way of control. We have satisfied ourselves that distribution is widespread. It is getting worse. When we come down to

a plan of action, the first thing we have to think about is money. Then we have to think of lines of authority--in other words, a scheme of action.

I might say the money that is going into the plague program at present is something as follows: There is in round figures \$51,000 of the epidemic fund of the United States Public Health Service which is being used chiefly for defining the areas and reservoirs of infection. In addition to that, \$124,000 in round figures is going into the program from the States for essentially the same purpose. In other words, a total of \$175,000 in round figures, but, of the \$124,000 going in from the States, \$99,095 is Title VI money which is reallocated by the States and \$24,905 represents actual State appropriations. The exact sum that is going into plague work may be a little more or a little less. This is the best approximation we can get from budgets on file with the Public Health Service. As you understand, it is difficult to give exact figures because one person frequently does other jobs at different times of the year; so, while I say these are not absolute figures, they are good enough for the purpose of our discussion here today.

We have recommended to the Federal Security Agency that our appropriation for next year--that is, beginning July 1, 1942, be increased to \$270,000. The States also will have to increase their amounts. How the Agency will treat our request, we don't know. Nor do we know what its fate will be at the hands of the Budget Bureau and Congress.

Now let us revert specifically to the content of the proposed program. Suppose we continue at the same level of appropriation or even if it should be increased--should we go on mapping out foci of infection or should we perhaps in addition carry on some educational work, such as teaching people to stay away from squirrels and other rodents? If we adopt such a program, how many years should that be continued--one, two, three, or four--or have we got enough information of a survey character at the present time? Should we abandon the kind of thing we are doing, and put all this money into control work?

So far we have only considered the appropriation of the Federal Government and of the States. We have learned from experiences in other lines of work that the cities can be stimulated to put considerable money into control work. Perhaps a large part of our efforts should go towards getting cities to take up rat control work, including better disposal of garbage. As I understand it, the proper method of garbage disposal is one of the most effective ways we have of taking care of the rodent problem. I haven't answered any question, but these are the ones facing us. They are the ones upon which at least some tentative decision should be reached before we adjourn.

Dr. Parran has asked for suggestions as to how we should proceed from here on. In preparing the program I had in mind that he would summarize the discussion. Perhaps the discussion has been too disjointed for summarization. Perhaps we should have a committee report back later this evening or tomorrow morning on a plan of action, the content of the program that ought to be pursued, the distribution of the cost, etc.

I would suggest that we reach decisions on all of these points and have them set forth in fairly positive statements before we adjourn. Otherwise, this will have been just another meeting; we will have talked, we will have

gained a little information, but we will not have crystallized out any course of action on which we can unite.

DR. BEATTY:

I think nothing appeared in the discussion with reference to the economics of the rat problem. I have seen estimates stating that the annual cost per rat is \$2.50. Does anybody here have any more accurate information about that? Assuming that this is correct, it would seem to me that it would be economical to spend the money in stopping the rats. I seriously would like to ask whether any estimate worthy of consideration has been made with regard to the cost of the support of a rat per year.

DR. PARRAN:

Dr. C. L. Williams, have you any estimate?

DR. WILLIAMS:

Well, I don't think there is any accurate estimate of either the number of rats in this country or the amount of damage they do. As I recall, the last statement of the United States Department of Agriculture was to the effect that rats are destroying, on the average, somewhere between \$2.00 and \$3.00 worth of goods per rat per year, and that there were something like 200,000,000 rats in the United States. On this basis, the loss during a year would be about half a billion dollars.

ANONYMOUS:

I would like to raise the question of garbage disposal in the cities, and ask if Dr. Williams knows of any city that is operating with a more or less model ordinance?

DR. WILLIAMS:

There is almost any kind of procedure you want to name in some city or other. The most prevalent method is taking garbage out and dumping it. Some cities have very strict rules as to how garbage should be taken care of. If the original container is maintained in a tight condition, so the rats can't get at it from the moment it leaves the house until it is finally disposed of, it is quite a factor in controlling rats. If the original content is in sight, that is obviously one of the great sources of rat food. There are some cities in which the control of garbage is pretty fair; in many others it is very poor.

ANONYMOUS:

Does the method of garbage control provide a good index as to the rat population?

DR. WILLIAMS:

I don't recall any thorough going study of the actual relationship, but in New Orleans in 1941 one of the factories used a rather carefully controlled program. I don't know of any studies which would give you any definite figures.

DR. MCKAY:

I move that the Chairman appoint a committee upon which will be represented the States which have active campaigns at the present time and which are in a position to report actual costs, and also representatives from the Public Health Service who are authorities on this subject. I also move that the committee report a definite coordinated plan of action at the morning session.

DR. HAMER:

I second the motion.

DR. PARRAN:

Is there any discussion?

DR. MOUNTIN:

I raise the question as to whether we might conclude the conference this evening. This is the main topic that remains--that is, the crystallization of viewpoints. The committee has not been appointed, but I wonder if we adjourn promptly and reconvene at 7:30 p. m. or 8:00 p. m. if we cannot perhaps finish the business this evening.

DR. MCKAY:

I will accept that as an amendment to the motion.

DR. PARRAN:

Any further discussion? If not, are you ready for the question?

ANONYMOUS:

Question!

DR. PARRAN:

All those in favor of the motion as amended say "Aye". (Motion carried).

DR. PARRAN:

Dr. Brown of California, Dr. Evans of Washington, and Dr. McKay of Utah will be the three members of the committee. Dr. Creel, Dr. Wayson, and Dr. C. L. Williams will be available to the committee of State health officers as consultants rather than actual committee members. I would like to consider this as a report with brief recommendations coming from the State officials of the twelve States concerned.

Meeting adjourned at 4:40 p. m.

REPORT OF THE EXECUTIVE SESSION OF THE PLAGUE CONTROL CONFERENCE
HELD IN THE JADE ROOM, HOTEL UTAH, SALT LAKE CITY, AT 8:25 P. M.
AUGUST 28, 1941

PRESIDING: Doctor Thomas Parran, Surgeon General of the United States Public Health Service.

PRESENT: United States Public Health Service: Doctors Thomas Parran, J. W. Mountin, R. H. Creel, L. A. Fullerton, C. L. Williams, N. E. Wayson, W. T. Harrison, ~~Karl V. Akin~~, and Former Surgeon General Hugh S. Cumming.
Charles V. Akin

Consultants: Doctors W. S. Shepherd and K. F. Meyer.

State Health Officers from the 12 Western States: Doctors G. F. Manning, Arizona; Bertram P. Brown, California; R. L. Cleere, Colorado; E. L. Berry, Idaho; W. F. Cogswell, Montana; Edward E. Hamer, Nevada; James R. Scott, New Mexico; Maysil M. Williams, North Dakota; Frederick Stricker, Oregon; William M. McKay, Utah; Donald Evans, Washington; and M. C. Keith, Wyoming.

The meeting was called for the purpose of hearing the report of the committee appointed at the afternoon session consisting of State Health Officers Bertram P. Brown, Donald Evans, and William M. McKay; and Consultants R. H. Creel, C. L. Williams, and N. E. Wayson.

Upon the suggestion of Chairman Brown the report of the committee was read by Doctor McKay. After considerable discussion, a number of amendments were suggested and adopted and Doctor Brown moved the adoption of the report. The report as adopted is appended to these minutes.

A vote on the motion was made by roll call. With the exception of Doctor Cogswell of Montana, who voted "present," all State health officers voted to adopt the report. Doctor Cogswell voted "present" because "plague is not a problem in Montana."

It was suggested by Doctor Brown of California that the State health officers send copies of the report to their representative in Congress and at the same time call their attention to the necessity of immediate action by Congress in making funds available to carry out an effective plague control program.

Doctor Maysil Williams, State Health Officer of North Dakota, was then asked by Doctor Parran to make a report on the encephalitis epidemic now raging in North Dakota.

Doctor Williams reported that to date approximately 750 cases of human encephalitis had been reported to the State Health Department with a fatality rate of slightly less than 10 percent.

Further remarks on the encephalitis situation were made by Doctors Parran, Meyer, and Parker.

Doctor Meyer reported that his investigators had definitely implicated a certain species of mosquito as a vector of encephalitis.

Doctor Parran then suggested that all present express by a standing vote their appreciation to Doctor McKay and his staff for the courtesies extended to those in attendance at the conference.

Meeting adjourned at 10:00 P. M.

William M. McKay, M. D.
Secretary of the Conference.

REPORT OF THE COMMITTEE OF THE PLAGUE CONTROL CONFERENCE

Salt Lake City, Utah - August 28, 1941

Plague is prevalent in all of the Rocky Mountain and Pacific Coast States. During the current year it has been discovered for the first time in Colorado and North Dakota.

More than 26 species of rodents have been implicated as susceptible to plague infection.

Plague has reappeared among rats in San Francisco and the East Bay cities of Oakland, Richmond, and Berkeley during 1941 after having been absent since 1924.

The Public Health Service maintains a plague laboratory in San Francisco and four field units each consisting of a truck with two hunters and trappers. This force is supplemented by thirteen units financed by State health departments with Federal aid. These survey units are entirely inadequate to cover the approximately 1,000,000 square miles in 12 western States which are known to be plague-infected. With this inadequate force, surveys cannot be made with sufficient frequency or intensity to define accurately the exact extent and distribution of the plague problem in the 12 States where the infection exists.

The plague problem is potentially of grave public health importance. The history of this disease over a period of centuries shows that it has several times assumed epidemic proportions, especially in cities. History also shows that when the disease appears in bubonic form contracted from rat fleas, it sooner or later may assume the pneumonic type and be spread from person to person with fatal results.

In addition to the ever-present hazard to dwellers in the rural areas the present situation in the United States has serious public health, economic, and military potentialities for the following reasons:

(1) The discovery of plague-infected foci progressively farther eastward suggests the possibility of epizootics among rats which are very prevalent in cities of the Mississippi Valley.

(2) Reintroduction of plague infection is likely in additional West Coast cities and may create an increased burden of unknown magnitude to our foreign commerce through quarantine measures imposed by other countries against the United States under provisions of treaties to which the United States is signatory.

(3) Military concentrations and maneuvers in any of these western States will constitute a real hazard to the soldier unless extensive rodent control is carried out in all such areas. This applies particularly to the Boise and Hunter Liggett areas.

In its very nature the plague problem is one which cannot be handled by State authorities alone. The technical leadership and financial assistance of the Federal Government are necessary, not only from the standpoint of

effective control but also because the United States has assumed definite treaty obligations to control plague and to prevent its introduction into ports.

From the evidence presented to the conference it appears that complete control of plague is not economically feasible without a great increase in Federal, State, and local expenditures. It appears that there is great value in surveying as extensively as possible to determine the locations of infected rodents. The information obtained from such surveys indicates the necessary control measures which must be carried out. Funds must be made available for adequate survey and control work.

An educational campaign is recommended to bring about greater appreciation of the dangers inherent in permitting rodents in close contact with human habitation in areas which are infected, in permitting further spread eastward of plague infection, and in permitting city rats to be infected by wild rodents, especially ground squirrels.

It is further recommended that adequate supervision of garbage disposal procedures be carried out as a means of reducing the rat population in urban areas and thereby preventing transference of infection from wild rodents to city rats. This should complement intensive rat-proofing and eradication measures in all cities and population centers as a means of controlling not only plague but in addition typhus fever and other disease in which rats are involved.

In order to prevent the spread of plague from wild rodents to urban rats it is recommended that rodent-free zones be established around all towns and cities.

Because of the comparatively short season in which survey and rodent-eradication measures may be effected in certain of the States, and the difficulty of such States in annually obtaining qualified seasonal employees for the work, it is recommended that the United States Public Health Service assume the responsibility of assembling equipment, supplies, and staffs which it will make available to such States.

In order to carry out the above measures, which constitute a minimum program to prevent the further spread of plague, it is recommended that the United States Public Health Service expend annually \$900,000 and that the State and local health agencies expend an equal amount for the control of plague.

- 61 -
RODENT PLAGUE - 1941

